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Energy Research Abstracts

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UNITED STATES DEPARTMENT OF ENERGY

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Energy Research Abstracts

Coverage

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports and patent applications originated by the U.S. Department of Energy, its laboratories, energy centers, and contractors, as well as theses and conference papers and proceedings issued by these organizations in report form. Audiovisual materials, computer media (magnetic tapes, diskettes, etc.), and engineering drawings are included in this definition. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations, *provided* that the full text of the document has been received by OSTI. Foreign report information is obtained through the International Energy Agency's 18-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. The purpose of this publication is to announce documents produced or obtained by DOE that are not so readily available as journal articles, books, or patents.

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The scope of *ERA* encompasses DOE's research, development, demonstration, and technology programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for online searching as records within the Energy Science and Technology Database (EDB). The current-year records are available on the Integrated Technical Information System (ITIS).

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ERA (regular issues and annual indexes) is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Managing Editor, Leota S. Kane
Technical Editor, Barry C. Steele

Information Sources

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- Switzerland
- The Netherlands
- United Kingdom
- United States

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The principal data elements included in these citations are:

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4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Date of publication.** If not known, a processing date is in brackets.
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11. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
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15. **Conference title, location, and date,** if applicable.
16. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
17. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
18. **Drop note** or explanatory statement.
19. **Abstract.**
20. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

54 (DOE/ER/60888-1-Vol.1, pp. 115-117) **Investigation of air pollution in house due to use of various fuels.** Luo, Dayu (Chengdu Sanitation (China)). Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. (CONF-900724-Vol.1: Indoor Air '90: 5th international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). In Indoor air '90: The fifth international conference on indoor air quality and climate. Volume 1: Final report. 786p. Order Number DE90017786. Source: NTIS.

Air pollution in houses caused by combustion of coal is more serious than that by combustion of natural gas and methane (primarily by SO_2 and NO_2). The gas concentration after cooking is higher than that before cooking, and it is higher in kitchen than in bedroom and outdoor. There were mutations in the extract from TSP in $30m^2$ air in the bedroom, kitchen and outdoor, where coal and natural gas were used. The supernatant saliva activity of children whose family uses coal is significantly lower than that of pumping streams.

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 2 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) OSTI prices are based on total pages unless special pricing applies. The public should order from NTIS or from one of the other agencies listed in the citation. NTIS price codes may continue to appear in some records. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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Government Printing Office
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INIS *Available only in microfiche.*
INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS U.S. Department of Commerce
Technology Administration
National Technical Information Service
Springfield, VA 22161

OSTI U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
Fax: (423) 576-2865
E-mail: reports@adonis.osti.gov

ESTSC Energy Science and Technology Software Center
P.O. Box 1020
Oak Ridge, TN 37831-1020

CASI Attention: Document Order
NASA Center for AeroSpace Information
800 Elkridge Landing Road
Linthicum Heights, MD 21090-2934

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1	15:18494	NTIS, OSTI	E 1.99: DE89007246	MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the database records.* The following list includes all of the 38 first-level and the 313 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in ETDE/PUB--1-R2, *International Energy: Subject Categories and Scope*.

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Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

Refer also to citation(s) 23725

22978 (NEDO-C–9301) **Subsidies for promotion of coal production/utilization technology. Second Clean Coal Technology (CCT) Conference.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Jul 1993. 242p. (In Japanese). Order Number DE95790769. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

The paper summarizes the first and second Conferences of Clean Coal Technology (CCT) as follows: as for significance and positioning of CCT, it is important to see how CCT is related to the purpose of making a clean use of coal. CCT should be related not only to the utilization, but to all the stages of production, distribution and utilization. As international cooperation concerning CCT, it is important to make a wide variety of menu for a policy for coal clean use which is largely expected to spread. In that case, it is important to transfer technology having hardware and software in one body and train persons for it. As to technology development and a role of NEDO, CCT now seeks a new idea on the R and D and the technology development. Further, NEDO should play a principle role in the long-term technology development in the basic and introductive field of CCT.

0103 Preparation

22979 (CONF-941089–Vol.2, pp. 665-674) **Precombustion desulfurization using Microcel™ and multi-gravity separator.** Yoon, R.H. (Virginia Polytechnic Institute and State Univ., Blacksburg, VA (United States)); Luttrell, G.H.; Venkatraman, P. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

Studies conducted at the Center for Coal and Minerals Processing (CCMP) indicate that surface-based processes such as froth flotation are inefficient in removing pyrite from fine coal. This shortcoming has been attributed to the fact that pyrite can become hydrophobic under certain conditions and to the inability of flotation to reject middling particles. To overcome these deficiencies, a new processing scheme has been developed at CCMP which involved the use of the Microcel™ flotation column in combination with a centrifugal flowing-film separator, called a Multi-Gravity Separator (MGS). The flotation column removes ash-forming minerals such as clay, while the MGS is effective in removing pyrite. Preliminary test data obtained with high-sulfur coals shows that this processing scheme can nearly double the pyritic sulfur rejection with little loss in clean coal yield. This article discusses the underlying principles of the new circuit and provides test results obtained using eastern U.S. coals.

22980 (DOE/PC/91043–T13) **An investigation of the role of water on retrograde/condensation reactions and enhanced liquefaction yields. Final report.** Miknis, F.P.; Netzel, D.A.; Wallace, J.C. Jr.; Butcher, C.H.; Mitzel, J.M.; Turner, T.F. Western Research Inst., Laramie, WY (United States). Feb 1995. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91043 ; FG22-91PC91310 ; FG05-89ER75506. Order Number DE95015452. Source: OSTI; NTIS; GPO Dep.

While great strides have been made in developing the technology of coal liquefaction processes in recent years, many unsolved problems still remain before a viable and economical process can be achieved. The technological problems that still exist can be solved through a more fundamental understanding of the chemistry associated with each stage of the coal liquefaction process, starting with any pretreatment steps that may be carried out on the coal itself. Western Research Institute, under the a contract from the US Department of Energy, has conducted a study of different methods of coal drying as pretreatment steps before liquefaction. The results of that study are the subject of this report. Coals that were dried or partially dried thermally and with microwaves had lower liquefaction conversions than coals containing equilibrium moisture contents. However, chemically dried coals had conversions equal to or greater than the premoisturized coals. The conversion behavior is consistent with changes in the physical structure and cross linking reactions because of drying. Thermal and microwave drying appear to cause a collapse in the pore structure, thus preventing donor solvents such as tetralin from contacting reactive sites inside the coals. Chemical dehydration does not appear to collapse the pore structure. From the study of the kinetics of the chemical dehydration of coals, it was possible to quantify the amount of water on the surface, the amount readily accessible in pores, and the amount more strongly bonded in the internal structure of the coals. The results indicate that high-rank coals have proportionally less surface and easily accessible water than the lower rank coals.

22981 (DOE/PC/92543–T10) **Micro-agglomerate flotation for deep cleaning of coal. Quarterly progress report, January 1, 1995–March 31, 1995.** Chander, S.; Hogg, R. Pennsylvania State Univ., University Park, PA (United States). Apr 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92PC92543. Order Number DE95015535. Source: OSTI; NTIS; GPO Dep.

The development of practical technologies for the deep cleaning of coal has been seriously hampered by the problems of carrying out efficient coal/mineral separations at the very fine sizes (often finer than 10 mm) needed to achieve adequate liberation of the mineral matter from the coal matrix. In froth flotation, selectivity is substantially reduced at fine sizes due, primarily, to overloading of the froth phase which leads to excessive carryover of water and entrained mineral matter. Oil agglomeration, on the other hand, can provide good selectivity at low levels of oil addition but the agglomerates tend to be too fragile for separation by the screening methods normally used. The addition of larger amounts of oil can yield large, strong agglomerates which are easily separated but the selectivity is reduced and reagent costs can become excessive. We are investigating the use of a hybrid process - Micro-agglomerate flotation which is a combination of oil-agglomeration and froth flotation. The basic concept is to use small quantities of oil to promote the formation of dense micro-agglomerates with minimal entrapment of water and mineral particles, and to use froth flotation to extract these micro-agglomerates from the water/dispersed-mineral phase. Since the floating units are agglomerates (about 30-50 mm in size) rather than individual coal particles (1-10 mm) the problems of froth overload and water/mineral carryover should be significantly alleviated. There are, however, complications. The process involves at least five phases: two or more solids (coal and mineral), two liquids (oil and water) and one gas (air). It is necessary to maintain precise control over the chemistry of the liquid phases in order to promote the interfacial reactions and interactions between phases necessary to ensure selectivity. Kinetics as well as thermodynamic factors may be critical in determining overall system response.

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Refer also to citation(s) 22980, 23002, 23013, 23028, 23029, 23090, 23091, 23516, 23517, 23844, 23912, 23944

22982 (CONF-941089–Vol.2, pp. 647-664) **Clean coal technologies for gas turbines.** Todd, D.M. (GE Industrial & Power Systems, Schenectady, NY (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul

(Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The oil- and gas-fired turbine combined-cycle penetration of industrial and utility applications has escalated rapidly due to the lower cost, higher efficiency and demonstrated reliability of gas turbine equipment in combination with fuel economics. Gas turbine technology growth has renewed the interest in the use of coal and other solid fuels in combined cycles for electrical and thermal energy production to provide environmentally acceptable plants without extra cost. Four different types of systems utilizing the gas turbine advantages with solid fuel have been studied: direct coal combustion, combustor processing, fuel processing and indirect cycles. One of these, fuel processing (exemplified by coal gasification), is emerging as the superior process for broad scale commercialization at this time. Advances in gas turbine design, proven in operation above 200 MW, are establishing new levels of combined-cycle net plant efficiencies up to 55% and providing the potential for a significant shift to gas turbine solid fuel power plant technology. These new efficiencies can mitigate the losses involved in gasifying coal and other solid fuels, and economically provide the superior environmental performance required today. Based on demonstration of high baseload reliability for large combined cycles (98%) and the success of several demonstrations of Integrated Gasification Combined Cycle (IGCC) plants in the utility size range, it is apparent that many commercial IGCC plants will be sites in the late 1990s. This paper discusses different gas turbine systems for solid fuels while profiling available IGCC systems. The paper traces the IGCC option as it moved from the demonstration phase to the commercial phase and should now with planned future improvements, penetrate the solid fuel power generation market at a rapid pace.

22983 (CONF-950801–4) **Impact of organic-mineral matter interactions on thermal reaction pathways for coal model compounds.** Buchanan, A.C. III (Oak Ridge National Lab., TN (United States). Chemical and Analytical Sciences Div.); Britt, P.F.; Struss, J.A. Oak Ridge National Lab., TN (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 210. national meeting of the American Chemical Society; Chicago, IL (United States); 20-25 Aug 1995. Order Number DE95014282. Source: OSTI; NTIS; GPO Dep.

Coal is a complex, heterogeneous solid that includes interdispersed mineral matter. However, knowledge of organic-mineral matter interactions is embryonic, and the impact of these interactions on coal pyrolysis and liquefaction is incomplete. Clay minerals, for example, are known to be effective catalysts for organic reactions. Furthermore, clays such as montmorillonite have been proposed to be key catalysts in the thermal alteration of lignin into vitrinite during the coalification process. Recent studies by Hatcher and coworkers on the evolution of coalified woods using microscopy and NMR have led them to propose selective, acid-catalyzed, solid state reaction chemistry to account for retained structural integrity in the wood. However, the chemical feasibility of such reactions in relevant solids is difficult to demonstrate. The authors have begun a model compound study to gain a better molecular level understanding of the effects in the solid state of organic-mineral matter interactions relevant to both coal formation and processing. To satisfy the need for model compounds that remain nonvolatile solids at temperatures ranging to 450 C, model compounds are employed that are chemically bound to the surface of a fumed silica (Si-O-C_{aryl} linkage). The organic structures currently under investigation are phenethyl phenyl ether ($C_6H_5CH_2CH_2OC_6H_5$) derivatives, which serve as models for β-alkyl aryl ether units that are present in lignin and lignitic coals. The solid-state chemistry of these materials at 200–450 C in the presence of interdispersed acid catalysts such as small particle size silica-aluminas and montmorillonite clay will be reported. Initial focus will be on defining the potential impact of these interactions on coal pyrolysis and liquefaction.

22984 (DOE/MC/27391–4057) **Scale-up of mild gasification to a process development unit. Progress report, November 21, 1994–February 20, 1995.** Doane, E.P.; Carty, R.H.; Foster, H. Kerr-McGee Coal Corp., Oklahoma City, OK (United States). Mar 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC27391. Order Number DE95014923. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to develop the IGT Mild-Gasification (MILDGAS) process for near-term commercialization. The specific objectives of the program are to: design, construct, and operate a 24-tons/day adiabatic process development unit (PDU) to obtain process performance data suitable for further design scaleup; obtain large batches of coal-derived co-products for industrial evaluation; prepare a detailed design of a demonstration unit; develop technical and economic plans for commercialization of the MILDGAS process. The project team that is performing the initial phases of the PDU development are: Kerr-McGee Coal Corporation (K-M Coal), the Institute of Gas Technology (IGT), Bechtel Corporation (Bechtel), and Southern Illinois University at Carbondale (SIUC). The MILDGAS process is a continuous closed system for producing liquid and solid (char) co-products at mild operating conditions up to 50 psig and 1300°F. It is capable of processing a wide range of both eastern caking and western noncaking coals. The 1 ton/hr PDU facility that is to be constructed is comprised of a 2.5-ft ID adiabatic gasifier for the production of gases, coal liquids, and char; a three-stage condensation train to condense and store the liquid products; and coal feeding and char handling equipment. The facility will also incorporate support equipment for environmentally acceptable disposal of process waste. This quarter, Roberts and Schaefer (R&S) of Salt Lake City, Utah was awarded the contract to perform the detailed design for the gasification, liquids recovery and overall plant design coordination. They began work in December of 1994 and a meeting was held between R&S, Bechtel, and IGT to discuss control methods, detailed equipment design, the heavy liquids filter, and possible modifications to the first and second stage cyclones.

22985 (DOE/METC/C–95/7185) **Innovative gasification technology for future power generation.** Mahajan, K. (Dept. of Energy, Morgantown, WV (United States)); Shadle, L.J.; Sadowski, R.S. USDOE Morgantown Energy Technology Center, WV (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). (CONF-950646–23: Air and Waste Management Association meeting, San Antonio, TX (United States), 18-23 Jun 1995). Order Number DE95014482. Source: OSTI; NTIS; GPO Dep.

Ever tightening environmental regulations have changed the way utility and non-utility electric generation providers currently view their fuels choices. While coal is still, by far, the major fuel utilized in power production, the general trend over the past 20 years has been to switch to low-sulfur coal and/or make costly modifications to existing coal-fired facilities to reach environmental compliance. Unfortunately, this approach has led to fragmented solutions to balance our energy and environmental needs. To date, few integrated gasification combined-cycle (IGCC) suppliers have been able to compete with the cost of other more conventional technologies or fuels. One need only look at the complexity of many IGCC approaches to understand that unless a view toward IEC is adopted, the widespread application of such otherwise potentially attractive technologies will be unlikely in our lifetime. Jacobs-Sirrine Engineers and Riley Stoker Corporation are working in partnership with the Department of Energy's Morgantown Energy Technology Center to help demonstrate an innovative coal gasification technology called "PyGas™," for "pyrolysis-gasification". This hybrid variation of fluidized-bed and fixed-bed gasification technologies is being developed with the goal to efficiently produce clean gas at costs competitive with more conventional systems by incorporating many of the principles of IEC within the confines of a single-gasifier vessel. Our project is currently in the detailed design stage of a 4 ton-per-hour gasification facility to be built at the Fort Martin Station of Allegheny Power Services. By locating the test facility at an existing coal-fired plant, much of the facility infrastructure can be utilized saving significant costs. Successful demonstration of this technology at this new facility is a prerequisite to its commercialization.

22986 (DOE/PC/90011–T30) **Direct catalytic conversion of methane and light hydrocarbon gases. Final report, October 1, 1986–July 31, 1989.** Wilson, R.B. Jr.; Posin, B.M.; Chan, Yee-Wai. SRI International, Menlo Park, CA (United States). Jun 1995. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95015620. Source: OSTI; NTIS; GPO Dep.

This project explored conversion of methane to useful products by two techniques that do not involve oxidative coupling. The first approach was direct catalytic dehydrocoupling of methane to give hydrocarbons and hydrogen. The second approach was oxidation of methane to methanol by using heterogenized versions of catalysts that were developed as homogeneous models of cytochrome-P450, an enzyme that actively hydroxylates hydrocarbons by using molecular oxygen. Two possibilities exist for dehydrocoupling of methane to higher hydrocarbons: The first, oxidative coupling to ethane/ethylene and water, is the subject of intense current interest. Nonoxidative coupling to higher hydrocarbons and hydrogen is endothermic, but in the absence of coke formation the theoretical thermodynamic equilibrium yield of hydrocarbons varies from 25% at 827°C to 65% at 1100°C (at atmospheric pressure). In this project we synthesized novel, highly dispersed metal catalysts by attaching metal clusters to inorganic supports. The second approach mimics microbial metabolism of methane to produce methanol. The methane mono-oxygenase enzyme responsible for the oxidation of methane to methanol in biological systems has exceptional selectivity and very good rates. Enzyme mimics are systems that function as the enzymes do but overcome the problems of slow rates and poor stability. Most of that effort has focused on mimics of cytochrome P-450, which is a very active selective oxidation enzyme and has a metalloporphyrin at the active site. The interest in nonporphyrin mimics coincides with the interest in methane mono-oxygenase, whose active site has been identified as a μ-oxo dinuclear iron complex.We employed mimics of cytochrome P-450, heterogenized to provide additional stability. The oxidation of methane with molecular oxygen was investigated in a fixed-bed, down-flow reactor with various anchored metal phthalocyanines (PC) and porphyrins (TPP) as the catalysts.

22987 (DOE/PC/90054–T13) **Novel nanodispersed coal liquefaction catalysts: Molecular design via microemulsion-based synthesis. Technical progress report, October–December 1993.** Boakye, E.; Radovic, L.R.; Osseo-Asare, K. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. Sep 1994. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90054. Order Number DE95014749. Source: OSTI; NTIS; GPO Dep.

Three different synthesis protocols were used to synthesize nanosize molybdenum sulfide particles in the microemulsion system polyoxyethylene(5)nonylphenyl ether (NP-5)/cyclohexane/water: (a) acid-solubilized microemulsion plus tetrathiomolybdate (ASMPT), (b) tetrathiomolybdate-solubilized microemulsion plus acid (TSMPA) and (c) microemulsion plus microemulsion (MPM), i.e., acid-solubilized microemulsion plus tetrathiomolybdate-solubilized microemulsion. The particle size was found to depend on the synthesis method, especially at water-to-surfactant molar ratios (R) greater than 2.5. At R=3.5-4.5, the average particle size increased according to the synthesis method in the order: ASMPT < MPM < TSMPA. Furthermore, for each synthesis protocol, the average particle diameter increased with the water-to-surfactant molar ratio (R). These trends are rationalized by considering: (a) the increase in the rate of exchange of materials between the inverse micelles as R is increased, and (b) the different effects of the electrolytes (i.e., sulfuric acid and ammonium tetrathiomolybdate plus sodium hydroxide) on microemulsion stability.

22988 (DOE/PC/90054–T17) **Novel nanodispersed coal liquefaction catalysts: Molecular design via microemulsion-based synthesis. Final technical report, October 1990–December 1994.** Osseo-Asare, K. (and others); Boakye, E.; Vittal, M. Pennsylvania State Univ., University Park, PA (United States). Coll. of Earth and Mineral Sciences. Apr 1995. 301p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90054. Order Number DE95015961. Source: OSTI; NTIS; GPO Dep.

This report described the synthesis of Molybdenum Sulfides in microemulsions by acidification of ammonium tetrathiomolybdate. Molybdenum Sulfides have been shown to be potential coal liquefaction catalysts. The importance of particle size, temperature effects, and coal surface chemistry to impregnation are discussed.

22989 (DOE/PC/91029–T7) **Refining and end use study of coal liquids. Sixth quarterly technical progress report, December 19, 1994–March 26, 1995.** Bechtel National, Inc., San Francisco, CA (United States). [1995]. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93PC91029. Order Number DE95015618. Source: OSTI; NTIS; GPO Dep.

Bechtel, with Southwest Research Institute, Amoco Oil R&D, and the M.W. Kellogg Co. as subcontractors, initiated a study on November 1, 1993, for the U.S. Department of Energy's (DOE's) Pittsburgh Energy Technology Center (PETC) to determine the most cost effective and suitable combination of existing petroleum refinery processes needed to make specification transportation fuels or blending stocks, from direct and indirect coal liquefaction product liquids. This 47-month study, with an approved budget of $4.4 million dollars, is being performed under DOE Contract Number DE-AC22-93PC91029. A key objective is to determine the most desirable ways of integrating coal liquefaction liquids into existing petroleum refineries to produce transportation fuels meeting current and future, e.g. year 2000, Clean Air Act Amendment (CAAA) standards. An integral part of the above objectives is to test the fuels or blends produced and compare them with established ASTM fuels. The comparison will include engine tests to ascertain compliance of the fuels produced with CAAA and other applicable fuel quality and performance standards. The final part of the project includes a detailed economic evaluation of the cost of processing the coal liquids to their optimum products. The cost analyses is for the incremental processing cost; in other words, the feed is priced at zero dollars. The study reflects costs for operations using state of the art refinery technology; no capital costs for building new refineries is considered. Some modifications to the existing refinery may be required. Economy of scale dictates the minimum amount of feedstock that should be processed.

22990 (DOE/PC/91058–T14) **Rate enhancement for catalytic upgrading coal naphthas. Final of final technical progress report, July 1991–September 1994.** Davis, B.H. Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. [1995]. 210p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91058. Order Number DE95015623. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to remove sulfur, nitrogen, and oxygen from naphtha derived from coal liquefaction. The project is concerned with the development of hydrotreating catalysts. This period, a ruthenium sulfide catalyst has been studied.

22991 (DOE/PC/91304–T13) **Low severity upgrading of F-T waxes with solid superacids. Quarterly report, January 1995–March 1995.** Tierney, J.W.; Wender, I. Pittsburgh Univ., PA (United States). Dept. of Chemical and Petroleum Engineering. 6 Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91304. Order Number DE95015605. Source: OSTI; NTIS; GPO Dep.

In this quarter we studied the effect of hydrogen pressure, and of sulfur and nitrogen containing compounds on the isomerization and hydrocracking of n-hexadecane using a $Pt/ZrO_2/SO_4$ catalyst. The reactions were carried out at 300°C and hydrogen pressures between 50 and 500 psig. Increasing hydrogen pressure resulted in increased conversion and increased hydrocracking. Nitrogen containing compounds had a greater inhibiting effect on the conversion of n-hexadecane than sulfur-containing compounds. The reaction of diphenylmethane in air at 25°C and in the presence of sulfated zirconia was studied as a possible means to characterize the protonic acidity of solid superacids.

22992 (DOE/PC/92108–T8) **Technology development for cobalt F-T catalysts. Quarterly technical progress report No. 8, July 1, 1994–September 30, 1994.** Singleton, A.H. Energy Research and Development International, Inc., Pittsburgh, PA (United States). 18 Apr 1995. 197p. Sponsored by USDOE, Washington,

DC (United States). DOE Contract AC22-92PC92108. Order Number DE95014321. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to investigate the influence of various promoters, additives, and supports on minimizing the methane selectivity and increasing the water-gas shift (WGS) activity of cobalt (Co) Fischer-Tropsch (F-T) catalysts. The ultimate goal of this investigation is to identify and demonstrate a catalyst preparation procedure that will be scaled up for the reproducible synthesis of commercial quantities of supported Co catalysts with desired activity, selectivity, and lifetime for use in F-T synthesis in three-phase slurry bubble column reactors. Accomplishments for this quarter are: Four new catalysts were formulated and prepared during this period under both subtasks 1.2 and 1.3 and five more catalysts were prepared by Calsicat; The characterization of all the catalysts in order to determine their physical properties (BET surface area, pore volume, pore size diameter, particle size distribution), as well as the cobalt reducibility, extent of reduction, and dispersion) was continued; Seven new catalysts have been tested for their F-T synthesis performance; An investigation of the effect of pre-treatment (i.e. calcination in static air versus flowing air, direct reduction without prior calcination) of a selected number of catalysts upon their performance for F-T synthesis was continued during this period.

22993 (DOE/PC/92109–T8) **Direct aromatization of methane. Quarterly technical progress report No. 9, October 1, 1994–December 31, 1994.** Altamira Instruments, Inc., Pittsburgh, PA (United States). 30 May 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92109. Order Number DE95015615. Source: OSTI; NTIS; GPO Dep.

Further experiments have been performed on the assisted pyrolysis by the addition of a free-radical initiator, as well as on the initiation of pyrolysis by a solid surface using a variety of catalysts. The reaction has been studied in the temperature range of 850-1100°C, methane flow rates of 475-1000 Scc/min, and ethane flow rates of 21-42 Scc/min. Significant reduction in the pyrolysis temperature was observed in both cases, with measurable amounts of methane being converted at temperatures as low as 850°C. When ethane was added as a free-radical initiator, the major pyrolysis products were ethylene and propylene at temperatures below 950°C. At higher pyrolysis temperatures, the selectivity shifted toward benzene and acetylene which became the main analyzable products at 1050°C and 1100°C.

22994 (DOE/PC/92119–T7) **Microbial recovery of metals from spent coal liquefaction catalysts. Final and quarterly report, July 1994–September 1994.** Sandbeck, K.A.; Cleveland, D. Geo-Microbial Technologies, Inc., Ochelata, OK (United States). [1995]. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92119. Order Number DE95015515. Source: OSTI; NTIS; GPO Dep.

Research is reported on the recovery of molybdenum and nickel from spent coal liquefaction catalysts. Mo release from spent coal liquefaction catalysts has been shown to be dependent upon many parameters, but release is dominated by microbial growth. The microbial Mo release is a rapid process requiring less than one week for 90% of the releaseable Mo to be solubilized from whole washed (THF) catalyst. It could be expected that the rates would be even greater with crushed catalyst. Efforts were centered on optimizing the parameters that stimulate microbial growth and action and further efforts centered on catalyst pre-treatment prior to microbial bio-leaching. Recent experiments suggest that hydrogen peroxide promises to be an effective pre-treatment wash. Hydrogen peroxide was also found to be an effective and economical agent for metals solubilization per se and could promote solubilization without subjecting the catalyst to microbial growth.

22995 (DOE/PC/92121–T9) **High conversion of coal to transportation fuels for the future with low HC gas production. Progress report Number 10, January 1–March 31, 1995.** Wiser, W.H.; Oblad, A.G. Utah Univ., Salt Lake City, UT (United States). Dept. of Chemical and Fuels Engineering. Apr 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92121. Order Number DE95015478. Source: OSTI; NTIS; GPO Dep.

An objective of the Department of Energy in funding research in coal liquefaction, is to produce a synthetic crude from coal at a cost lower than $30.00 per barrel (Task A). A second objective is to produce a fuel which is low in aromatics, yet of sufficiently high octane number for use in the gasoline-burning transportation vehicles of today. To meet this second objective, research was proposed for conversion of the highly-aromatic liquid product from coal conversion to a product high in isoparaffins, which compounds in the gasoline range exhibit a high octane number (Task B). Experimental coal liquefaction studies conducted in a batch microreactor have demonstrated potential for high conversions of coal to liquids with low yields of hydrocarbon (HC) gases, hence small consumption of hydrogen in the primary liquefaction step. Ratios of liquids/HC gases as high as 30/1, at liquid yields as high as 82% of the coal by weight, have been achieved. The principal objective of this work is to examine how nearly one may approach these results in a continuous-flow system, at a size sufficient to evaluate the process concept for production of transportation fuels from coal. A continuous-flow reactor system is to be designed, constructed and operated. The system is to be computer-operated for process control and data logging, and is to be fully instrumented. The primary liquid products will be characterized by GC, FTIR, and GC/MS, to determine the types and quantities of the principal components produced under conditions of high liquids production with high ratios of liquids/HC gases. From these analyses, together with GC analyses of the HC gases, hydrogen consumption for the conversion to primary liquids will be calculated. Conversion of the aromatics of this liquid product to isoparaffins will be investigated. Results to date on both tasks are presented.

22996 (DOE/PC/92529–T10) **Transient studies of low temperature catalysts for methane conversion. Quarterly technical progress report, January 1, 1995–March 31, 1995.** Notre Dame Univ., IN (United States). Dept. of Chemical Engineering. [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92PC92529. Order Number DE95015604. Source: OSTI; NTIS; GPO Dep.

Previous results showed that a 3% Rh/TiO_2 catalyst was active during synthesis gas formation at temperatures significantly lower than those previously reported in the literature. In order to better understand the nature of the surface interactions between reacting gases and the catalyst surface, a series of transient experiments were conducted. The experiments consisted of pulses of methane and oxygen/methane mixtures diluted in helium carrier gas. In addition, temperature programmed desorption (TPD) studies were carried out on the fresh and used (post-run), Rh/TiO_2catalyst. The purpose of this study was to learn about the effect of the long residence time reaction on the surface activity of the catalyst. The objective of the pulse experiments was to determine the role of surface and lattice oxygen during methane activation process.

22997 (DOE/PC/93053–T3) **Cooperative Research Program in coal liquefaction. Technical report, May 1, 1994–October 31, 1994.** Consortium for Fossil Fuel Liquefaction Science, Lexington, KY (United States). [1994]. 227p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93PC93053. Order Number DE95016283. Source: OSTI; NTIS; GPO Dep.

Progress reports are presented for the following tasks: coliquefaction of coal with waste materials; catalysts for coal liquefaction to clean transportation fuels; fundamental research in coal liquefaction; and in situ analytical techniques for coal liquefaction and coal liquefaction catalysts.

22998 (DOE/PC/93069–4) **Development of precipitated iron Fischer-Tropsch catalysts. Quarterly technical progress report, 1 January 1995–31 March 1995.** Bukur, D.B.; Lang, X.; Reddy, B. Texas A and M Univ., College Station, TX (United States). Dept. of Chemical Engineering. 23 May 1995. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-94PC93069. Order Number DE95016676. Source: OSTI; NTIS; GPO Dep.

During the reporting period we completed synthesis of about 100 g of catalyst with nominal composition 100 Fe/3 Cu/4 K/16 SiO_2 (S-3416-2), and of another batch (173 g) of the same catalyst (S-3416-3). Also, we synthesized two additional batches of catalyst with nominal composition 100 Fe/5 Cu/6 K/24 SiO_2, in the amounts of 240 g (S-5624-3) and 200 g (S-5624-4). These amounts are sufficient for all planned tests with these two catalysts for the entire

duration of this contract. The synthesized catalysts were characterized by atomic absorption, and BET surface area and pore size distribution measurements.

22999 (ETDE-BR–0023) **Bio desulfurization of mineral coal.** Santos, M.D.C. (Centro de Tecnologia Mineral (CETEM), Rio de Janeiro, RJ (Brazil)); Pinheiro, A.C.; Souza, V.P. No corporate text available. 1991. 1p. (In Portugese). (CONF-9107186–: 2. Brazilian Fair and Congress on Biotechnology; 1. Latin American Fair and Congress on Biotechnology, Sao Paulo (Brazil), 6-10 Jul 1991). Order Number DE95789967. Source: OSTI; NTIS (US Sales Only).

Short communication COAL/desulfurization; COAL/microbial leaching; COAL; DESULFURIZATION; BENCH-SCALE EXPERIMENTS; PARTICLE SIZE; EXTRACTION COLUMNS

23000 (SAND–95-1124C) **Hydrotreating of coal-derived liquids.** Stohl, F.V.; Lott, S.E.; Diegert, K.V.; Goodnow, D.C.; Oelfke, J.B. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950801–3: 210. national meeting of the American Chemical Society, Chicago, IL (United States), 20-25 Aug 1995). Order Number DE95013034. Source: OSTI; NTIS; GPO Dep.

The objective of Sandia's refining of coal-derived liquids project is to determine the relationship between hydrotreating conditions and Product characteristics. The coal-derived liquids used in this work were produced in HTI's first proof-of-concept run using Illinois No. 8 coal. Samples of the whole coal liquid product, distillate fractions of this liquid, and Criterion HDN-60 catalyst were obtained from Southwest Research Inc. Hydrotreating experiments were performed using a continuous operation, unattended, microflow reactor system. A factorial experimental design with three variables (temperature, (310°C to 388°C), liquid hourly space velocity (1 to 3 g/h/cm^3(cat)), pressure (500 to 1000 psig H_2) is being used in this project. Sulfur and nitrogen contents of the hydrotreated products were monitored during the hydrotreating experiments to ensure that activity was lined out at each set of reaction conditions. Results of hydrotreating the whole coal liquid showed that nitrogen values in the products ranged from 549 ppM at 320°C, 3 g/h/cm^3(cat), 500 psig H_2 to <15 ppM at 400°C, 1 g/h/cm^3(cat), 1000 psig H_2.

0105 Products and By-Products

Refer also to citation(s) 22994

23001 (DOE/PC/93220–T6) **Production of elemental sulfur and methane from H_2S and CO_2 derived from a coal desulfurization process. Quarterly technical progress report, January 1, 1995–March 31, 1995.** Jiang, X.; Khang, S.J. Cincinnati Univ., OH (United States). Dept. of Chemical Engineering. [1995]. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93PC93220. Order Number DE95015616. Source: OSTI; NTIS; GPO Dep.

During the sixth quarter of the project, simulations were carried out to investigate the feasibility of producing elemental sulfur and methane from hydrogen sulfide and carbon dioxide by using the overall reaction of H_2S and CO_2 based on the following equation: $4\ H_2S + CO_2 = 2\ S_2 + CH_4 + 2\ H_2O$. The results indicate that two reaction zones are required to realize the above reaction. The first reaction zone should be composed of multiple stages to recover the elemental sulfur without the equilibrium limitations. With optimum temperatures in each zone, the conversion can be increased significantly. The simulation also indicates less amounts of by-products, such as COS, CS_2 and SO_2. The limitation on the extraction of sulfur is directly related to the sulfur vapor pressure.

0106 Properties and Composition

Refer also to citation(s) 22997, 23026, 23032, 23033

23002 (DOE/PC/92104–T10) **Advanced thermally stable jet fuels. Technical progress report, April 1994–June 1994.** Schobert, H.H. (and others); Eser, S.; Song, C. Pennsylvania State Univ., University Park, PA (United States). Coll. of Earth and Mineral Sciences. Jul 1994. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92PC92104. Order Number DE95015516. Source: OSTI; NTIS; GPO Dep.

Research continued on coal-based, thermally stable, jet fuels. Significant progress has been made on the detection of polycyclic aromatic hydrocarbons present in highly stressed fuels, using high-performance liquid chromatography (HPLC) with diode-array detection. Gas chromatography is not able to detect compounds with $\geq$6 fused aromatic rings, but such compounds can be identified using the HPLC method. The concentration of such compounds is low in comparison to aromatics of 1-3 rings, but the role of the large compounds in the formation of solid deposits may be crucial in determining the thermal stability of a fuel. The unusual properties of fluid fuels in the near-critical region appear to have significant effects on their thermal decomposition reactions. This issue has been investigated in the present reporting period using n-tetradecane as a model compound for fuel decomposition. Temperature-programmed retention indices are very useful for gas chromatographic and gas chromatography/mass spectrometric analysis of coal and petroleum derived jet fuels. We have demonstrated this in the identification of components in two JP-8 fuels and their liquid chromatographic fractions. The role of activated carbon surfaces as catalysts in the thermal stressing of jet fuel was investigated using n-dodecane and n-octane as model compounds. In some cases the reactions were spiked with addition of 5% decalin to test the ability of the carbon to catalyze the transformation of decalin to naphthalene. We have previously shown that benzyl alcohol and 1,4-benzenedimethanol are effective stabilizers at temperatures $\geq$400°C for jet fuels and the model compound dodecane. The addition of ethanol to hydrocarbon/benzyl alcohol mixtures has a significant effect on the thermal stabilization of jet fuels above 400°C. Ethanol appears to function by reducing the benzaldehyde formed during the degradation of the benzyl alcohol. This reduction regenerates the benzyl alcohol.

23003 (DOE/PC/93202–6) **Molecular accessibility in oxidized and dried coals. Quarterly report, January 1995–March 1995.** Kispert, L.D. Alabama Univ., University, AL (United States). Dept. of Chemistry. Mar 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93PC93202. Order Number DE95015510. Source: OSTI; NTIS; GPO Dep.

The objective of this research project is to determine the molecular and structural changes that occur in swelled coal as a result of oxidation and moisture loss both in the presence and absence of light using our newly developed EPR spin probe method. The proposed study will make it possible to deduce the molecular accessibility distribution in swelled, oxidized APCS coal for each rank as a function of (1) size (up to 6 nm) and shape, (2) the relative acidic/basic reactive site distributions, and (3) the role of hydrogen bonding as a function of swelling solvents. The advantage of the EPR method is that it permits molecules of selected shape, size and chemical reactivity to be used as probes of molecular accessible regions of swelled coal. From such data an optimum catalyst can be designed to convert oxidized coal into a more convenient form and methods can be devised to lessen the detrimental weathering processes.

0108 Waste Management

Refer also to citation(s) 22994, 23043, 23090, 23091, 23517, 23519, 23520, 23522, 23523, 23524, 23525, 23912

23004 (CONF-941089–Vol.2, pp. 471-492) **Overview: Applicability of U.S. environmental control technologies for Korea.** Chun, S.W. (DOE Pittsburgh Energy Technology Center, PA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

A review of the applicability of US environmental control technologies for Korea is presented in outline form. The following topics are discussed: PETC coal research activities, environmental costs, environmental challenges, Clean Air Act requirements, additional regulations for air toxics, clean coal technologies (CCT)

approach, CCT help meet environmental challenges, utility options, research goals for advanced power systems, PETC Programs, the NO_x SO process, flue gas cleanup program, air toxics emissions, and retrofit NO_x control for coal-burning boilers.

23005 (CONF-941089–Vol.2, pp. 493-503) **GE's worldwide experience with IFO based gypsum producing flue gas desulfurization systems.** Saleem, A. (GE Environmental Systems, Lebanon, PA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The In-Situ Forced Oxidation (IFO) process to produce gypsum in a commercial scale flue gas desulfurization (FGD) system was first demonstrated by GE Environmental Systems in 1980 at the Monticello Generating Station of Texas Utilities. Since then, the IFO technology developed and demonstrated by GE has become the industry standard and is used extensively on a world-wide basis to produce both commercial and disposable-grade gypsum. The paper gives an overview of the development, demonstration, commercial design and current status of the IFO technology.

23006 (CONF-941089–Vol.2, pp. 505-556) **ABB wet flue gas desulfurization.** Niijhawan, P. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The wet limestone process for flue gas desulfurization (FGD) is outlined. The following topics are discussed: wet flue gas desulfurization, wet FGD characteristics, wet scrubbers, ABB wet FGD experience, wet FGD forced oxidation, advanced limestone FGD systems, key design elements, open spray tower design, spray tower vs. packed tower, important performance parameters, SO_2 removal efficiency, influence by L/G, limestone utilization, wet FGD commercial database, particulate removal efficiencies, materials of construction, nozzle layout, spray nozzles, recycle pumps, mist elimination, horizontal flow demister, mist eliminator washing, reagent preparation system, spray tower FGDS power consumption, flue gas reheat options, byproduct conditioning system, and wet limestone system.

23007 (CONF-941089–Vol.2, pp. 557-567) **Two years of outstanding AFGD performance, pure air on the Lakes Bailly Scrubber Facility.** Henderson, J. (Pure Air, Allentown, PA (United States)); Vymazal, D.C.; Styf, D.A. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The "Advanced Flue Gas Desulfurization (AFGD) Demonstration Project" is a $151.3 million cooperative effort between the U.S. Department of Energy and a project company of Pure Air, a general partnership of Air Products and Chemicals, Inc. and Mitsubishi Heavy Industries America, Inc. The goal of the AFGD project is to demonstrate that, by combining state-of-the-art technology, highly efficient plant operation and maintenance capabilities, and by-product gypsum sales, significant reductions of SO_2 emissions can be achieved at approximately one-half the life cycle of a conventional Flue Gas Desulfurization (FGD) system. Further, this emission reduction is achieved without generating solid waste and while minimizing liquid wastewater effluent. Briefly, this project entails the design, construction and operation of a nominal 600 MWe AFGD facility to remove SO_2 from coal-fired power plant flue gas at the Northern Indiana Public Service Company's Bailly Generating Station, located approximately 40 miles southeast of Chicago, Illinois. The facility is used to demonstrate a variety of advanced technical and business-related features, during a three-year period of operation which began in the summer of 1992. The aim of this demonstration is to accelerate near-term commercialization. Key features of the AFGD project are discussed. Construction of the scrubber is complete; operations began in June 1992, ahead of schedule and within budget. The Clean Coal demonstration project calls for three years of operations. After the three-year demonstration period, Pure Air on the Lake will continue to Own-and-Operate the scrubber for the next 17 years. This paper review the advanced wet flue gas desulfurization (FGD) design features, and the environmental and business features of the project. Also included are data on the first two years of successful operation.

23008 (CONF-941089–Vol.2, pp. 569-579) **Babcock & Wilcox technologies for power plant stack emissions control.** Polster, M. (Babcock & Wilcox, Barberton, OH (United States)); Nolan, P.S.; Batyko, R.J. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The current status of sulfur dioxide control in power plants is reviewed with particular emphasis on proven, commercial technologies. This paper begins with a detailed review of Babcock & Wilcox commercial wet flue gas desulfurization (FGD) systems. This is followed by a brief discussion of B&W dry FGD technologies, as well as recent full-scale and pilot-scale demonstration projects which focus on lower capital cost alternatives to conventional FGD systems. A comparison of the economics of several of these processes is also presented. Finally, technology selections resulting from recent acid rain legislation in various countries are reviewed.

23009 (CONF-941089–Vol.2, pp. 581-591) **Design considerations for wet flue gas desulfurization systems - wet scrubber hardware issues.** Hurwitz, H. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

About 20 years ago the first wet flue gas desulfurization systems installed on coal fired utility boilers in the United States were experiencing extreme operating problems. In addition to their failure to achieve the necessary SO_2 removal efficiencies, these FGD systems required a major investment in maintenance, both material and labor, just to remain operational. These first generation systems demonstrated that a lack of understanding of the chemistry and operating conditions of wet flue gas desulfurization can lead to diastrous results. As the air pollution control industry developed, both in the United States and in Japan, a second generation of FGD systems was introduced. These designs incorporated major improvements in both system chemistry control and in the equipment utilized in the process. Indeed, the successful introduction of utility gas desulfurization systems in Germany was possible only through the transfer of the technology improvements developed in the US and in Japan. Today, technology has evolved to a third generation of wet flue gas desulfurication systems and these systems are now offered worldwide through a series of international licensing agreements. The rapid economic growth and development in Asia and the Pacific Rim combined with existing problems in ambient air quality in these same geographic areas, has resulted in the use of advanced air pollution control systems; including flue gas desulfurization both for new utility units and for many retrofit projects. To meet the requirements of the utility industry, FGD systems must meet high standards of reliability, operability and performance. Key components in achieving these objectives are: FGD System reliability/operability/performance; FGD system supplier qualifications; process design; equipment selection. This paper will discuss each of the essential factors with a concentration on the equipment selection and wet scrubber hardware issues.

23010 (CONF-941089–Vol.2, pp. 593-611) **Cost effective treatment for wet FGD scrubber bleedoff.** Janecek, K.F. (EIMCO Process Equipment Company, Salt Lake City, UT (United States)); Kim, J.Y. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From

US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The dewatering of scrubber bleedoff gypsum is a thoroughly proven technology, whether for production of wallboard grade gypsum or environmentally responsible land fill. Careful review of the technology options will show which one is the most effective for the specific plant site. Likewise, a recipe for wastewater treatment for heavy metals removal can be found that will meet local regulatory limits. EIMCO has worldwide experience in FGD gypsum sludge dewatering and wastewater treatment. Contacting EIMCO can be the most important step toward a practical cost effective system for handling FGD scrubber bleed slurries.

23011 (CONF-941089–Vol.2, pp. 613-620) **Milliken Station Demonstration Project FDG retrofit update.** Alder, R.C. (and others); Jackson, C.E.; O'Dea, D.T. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The Milliken Clean Coal Demonstration Project is one of the nine Clean Coal Projects selected for funding in Round 4 of the U.S. DOE's Clean Coal Demonstration Program. The project's sponsor is New York State Electric and Gas Corporation (NYSEG). Project team members include CONSOL Inc., Saarberg-Holter-Umwelttechnik (SHU), NALCO/FuelTech, Stebbins Engineering and Manufacturing Co., DHR Technologies, and CE Air Preheater. Gilbert/Commonwealth is the Architect/Engineer and Construction Manager for the flue gas desulfurization (FGD) retrofit. The project will provide full-scale demonstration of a combination of innovative emission-reducing technologies and plant upgraded for the control of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions from a coal-fired steam generator without a significant loss of station efficiency. The overall project goals are the following: 98% SO_2 removal efficiency using limestone while burning high sulfur coal; up to 70% NO_x reduction using the NOXOUT selective non-catalytic reduction (SNCR) technology in conjunction with combustion modifications; minimization of solid waste by producing marketable by-products including commercial grade gypsum, calcium chloride, and fly ash; zero wastewater discharge; maintenance of station efficiency by using a high efficiency heat-pipe air heater system and a low-power-consuming scrubber system. The demonstration project is being conducted at NYSEG's Milliken Station, located in Lansing, New York. Milliken Station has two 150-MWe pulverized coal-fired units built in the 1950s by Combustion Engineering. The SHU FGD process and the combustion modifications are being installed on both units, but the NOXOUT process, Plant Economic Optimization Advisor (PEOA), and the high-efficiency air heater system will be installed on only one unit.

23012 (CONF-941089–Vol.2, pp. 675-692) **Emission and thermal performance upgrade through advanced control backfit.** Banerjee, A.K. (Stone & Webster Engineering Corporation, Boston, MA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

Reducing emission and improving thermal performance of currently operating power plants is a high priority. A majority of these power plants are over 20 years old with old control systems. Upgrading the existing control systems with the latest technology has many benefits, the most cost beneficial are the reduction of emission and improving thermal performance. The payback period is usually less than two years. Virginia Power is installing Stone & Webster's NO_x Emissions Advisor and Advanced Steam Temperature Control systems on Possum Point Units 3 and 4 to achieve near term NO_x reductions while maintaining high thermal performance. Testing has demonstrated NO_x reductions of greater than 20 percent through the application of NO_x Emissions Advisor on these units. The Advanced Steam Temperature Control system which has been operational at Virginia Power's Mt. Storm Unit 1 has demonstrated a signification improvement in unit thermal performance and controllability. These control systems are being combined at Units 3 and 4 to reduce NO_x emissions and achieve improved unit thermal performance and control response with the existing combustion hardware. Installation has been initiated and is expected to be completed by the spring of 1995. Possum Point Power Station Units 3 and 4 are pulverized coal, tangentially fired boilers producing 107 and 232 MW and have a distributed control system and a PC based performance monitoring system. The installation of the advanced control and automation system will utilize existing control equipment requiring the addition of several PCs and PLC.

23013 (DOE/MC/25140–4053) **Power systems development facility. Quarterly technical progress report, July 1, 1994–September 30, 1994.** Southern Co. Services, Inc., Birmingham, AL (United States). [1995]. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-90MC25140. Order Number DE95014479. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to evaluate hot gas particle control technologies using coal-derived gas streams. This will entail the design, construction, installation, and use of a flexible test facility which can operate under realistic gasification and combustion conditions. The major particulate control device issues to be addressed include the integration of the particulate control devices into coal utilization systems, on-line cleaning techniques, chemical and thermal degradation of components, fatigue or structural failures, blinding, collection efficiency as a function of particle size, and scale-up of particulate control systems to commercial size. The conceptual design of the facility was extended to include a within scope, phased expansion of the existing Hot Gas Cleanup Test Facility Cooperative Agreement to also address systems integration issues of hot particulate removal in advanced coal-based power generation systems. This expansion included the consideration of the following modules at the test facility in addition to the original Transport Reactor gas source and Hot Gas Cleanup Units: (1) Carbonizer/Pressurized Circulating Fluidized Bed Gas Source. (2) Hot Gas Cleanup Units to mate to all gas streams. (3) Combustion Gas Turbine. (4) Fuel Cell and associated gas treatment. This expansion to the Hot Gas Cleanup Test Facility is herein referred to as the Power Systems Development Facility (PSDF).

23014 (DOE/MC/26042–4059) **Advanced particle filter. Technical progress report No. 19, January 1995–March 1995.** American Electric Power Service Corp., Columbus, OH (United States). [1995]. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-89MC26042. Order Number DE95015514. Source: OSTI; NTIS; GPO Dep.

Tidd advanced particle filtration (APF) test runs 25 through 34 were completed during the first quarter of 1995. All Tidd testing was completed with the conclusion of APF test run 34 on 3/30/95. The Westinghouse activities supporting the APF operation during this quarter included processing of test data and participating in one APF borescope inspection. Data is included on the filter operation.

23015 (DOE/MC/26288–4060) **Sonic enhanced ash agglomeration and sulfur capture. Technical progress report, January 1995–March 1995.** Manufacturing and Technology Conversion International, Inc., Columbia, MD (United States). [1995]. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-89MC26288. Order Number DE95014947. Source: OSTI; NTIS; GPO Dep.

This program is focused on the process for bimodal ash agglomeration and simultaneous sulfur capture for the development of coal fired combustion gas turbines. The process also accommodates injection of alkali gettering materials. During this period, further dismantling of the existing bimodal test unit was performed. The design of a revised process development unit and hot gas cleanup unit have been completed.

23016 (DOE/MC/28162–4015) **Coolside waste management research. Quarterly report, October 1994–December 1994.** Kentucky Univ., Lexington, KY (United States). Center for Applied

Energy Research. Feb 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-91MC28162. Order Number DE95000085. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to investigate chemical, mineralogical, and physical changes in Coolside waste materials to determine suitability for environmentally safe disposal. A compilation of the field lysimeter leachate data from the lowest leachate transport tubes indicates a major shift in the solution mineral equilibria regime. The pH of the L3 lysimeter (~12.2) and elemental concentrations in the leachates is grossly different from L2 and L1 (e.g., pH ~10.5). Sulfate averaged to date ~10,000 to 12,000 ppm in L1 and L2 compared to ~1,700 ppm in L3. As the materials have the same composition, the preconditioning regime of the materials appears to have a major influence on the leachate chemistry. Soil gas measurements have now been completed for most of a growing season. $C0_2$ concentrations as high as >26,000 pm were found in the soil gas. The distribution of the gas in the soil indicates that the FGD material is a major sink for the gas and that carbonation reactions are a major force in the geochemical regime for these materials.

23017 (DOE/MC/30251–4068) **High-volume, high-value usage of flue gas desulfurization (FGD) by-products in underground mines. Quarterly report, October–December 1994.** Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. Mar 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-93MC30251. Order Number DE95009714. Source: OSTI; NTIS; GPO Dep.

Research under Subtask 2.2, Chemical and Mineralogical Characterization, included further refinement of mineralogical transformation and the initiation of a kinetic study. The expansion of the FGD materials during moisturizing is attributable to three reactions: the hydration of portlandite to slaked lime; the formation of ettringite from fly ash and anhydrite, and; the formation of gypsum from anhydrite. The sequence of these reactions are being examined in a kinetic study. Completion of the first 15 days of study finds the steady decrease in anhydrite with concomitant formation of ettringite (on fly ash surfaces) and gypsum (pore and crack in-fillings). Geotechnical characterization (Subtask 2.3) focused on swell experiments which will model in situ emplacement. Specimens of FGD material have been stored in 3-inch diameter pipe and, after 39 days, 0.5% of axial swell has been recorded with material strengths of 600 to 1,000 psi. Experiments to determine the amount of moisture loss due to the heat of hydration indicate about 9 to 10% of the water is lost. Confined swell tests are also underway with pressures of 15 to 20 psi recorded at 25 days. Work performed under Task 4 (Background for Phase 11) included determination of the compressive strengths for the experimental mine roof rock. Values in the 5,000 to 7,500 psi range were found, which is typical for this type of strata in the region. Work on the hydrologic monitoring program (Subtask 4.2) included completion of the hydraulic conductivity assessment of the strata, as well as completion of the monitoring well plan. The highest hydraulic conductivity was found for the Princes No. 3 coal seam with values of $1x10^{-3}$ feet/min. The weathered sandstone over the coal had conductivities in the 10^{-4} to 10^{-5} feet/min range.

23018 (DOE/MC/30252–4077) **Management of dry flue gas desulfurization by-products in underground mines. Quarterly report, January–March 1995.** Chugh, Y. (and others); Dutta, D.; Esling, S. Southern Illinois Univ., Carbondale, IL (United States). Dept. of Mining Engineering. Apr 1995. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-93MC30252. Order Number DE95009723. Source: OSTI; NTIS; GPO Dep.

On September 30, 1993, the U.S. Department of Energy, Morgantown Energy Technology Center and Southern Illinois University at Carbondale (SIUC) entered into a cooperative research agreement entitled "Management of Dry Flue Gas Desulfurization By-Products in Underground Mines" (DE-FC21-93MC 30252). Under the agreement Southern Illinois University at Carbondale will develop and demonstrate several technologies for the placement of coal combustion residues in abandoned coal mines, and will assess the environmental impact of such underground residues placement. Previous quarterly Technical Progress Reports have set forth the specific objectives of the program, as well as the management plan and the test plan for the overall program, and a discussion of these will not be repeated here. Rather, this report, will set forth the technical progress made during the period January 1 through March 31, 1995. The demonstration of the SEEC, Inc. technology for the transporting of coal combustion residues was completed with the unloading and final disposition of the three Collapsible Intermodal Containers (CIC). The loading and transport by rail of the three CIC's was quire successful; however some difficulties were encountered in the unloading of the containers. A full topical report on the entire SEEC demonstration is being prepared. As a result of the demonstration some modifications of the SEEC concept may be undertaken. Also during the quarter the location of the injection wells at the Peabody No. 10 mine demonstration site were selected. Peabody Coal Company has developed the specifications for the wells and sought bids for the actual drilling. It is expected that the wells will be drilled early in May.

23019 (DOE/PC/91344–T12) **Advanced separation technology for flue gas cleanup. Quarterly technical report No. 11, October 1994–December 1994.** Bhown, A.S. (and others); Alvarado, D.; Pakala, N. SRI International, Menlo Park, CA (United States). Dec 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC91344. Order Number DE95014989. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to develop a novel system for regenerable SO_2 and NO_x scrubbing of flue gas that focuses on (a) a novel method for regeneration of spent SO_2 scrubbing liquor and (b) novel chemistry for reversible absorption of NO_x. In addition, high efficiency hollow fiber contactors (HFC) are proposed as the devices for scrubbing the SO_2 and NO_x from the flue gas. The system will be designed to remove more than 95% of the SO_x and more than 75% of the NO_x from flue gases typical of pulverized coal-fired power plants at a cost that is at least 20% less than combined wet limestone scrubbing of SO_x and selective catalytic reduction of NO_x. In addition, the process will make only marketable byproducts, if any (no waste streams). The major cost item in existing technology is capital investment. Therefore, our approach is to reduce the capital cost by using high efficiency hollow fiber devices for absorbing and desorbing the SO_2 and NO_x. We will also introduce new process chemistry to minimize traditionally well-known problems with SO_2 and NO_x absorption and desorption. For example, we will extract the SO_2 from the aqueous scrubbing liquor into an oligomer of dimethylaniline to avoid the problem of organic liquid losses in the regeneration of the organic liquid.

0109 Environmental Aspects

Refer also to citation(s) 23046

23020 (INIS-BR–3504) **Environmental procedures for thermoelectric power plants by national mineral coal.** Serra, M.T.F.; Verney Gothe, C.A. de; Silva Ramos, R. da. ELETROBRAS, Rio de Janeiro, RJ (Brazil); ELETROSUL, Curitiba, PR (Brazil); Departamento Nacional de Producao Mineral (DNPM), Brasilia, DF (Brazil); CAEEB, Brasilia, DF (Brazil); Companhia Estadual de Energia Eletrica do Estado do Rio Grande do Sul, Porto Alegre, RS (Brazil). Jan 1990. 159p. (In Portuguese). Order Number DE95633429. Source: OSTI; NTIS (US Sales Only); INIS.

This paper presents the environmental impacts decursive of utilization of South-Brazilian mineral coal to generation of electric energy. This environmental impacts and alternatives of attenuating measures are presented and evaluated, containing the totality of productive cycle: mining, processing, transport, stock piling and use in thermoelectric power plants. Environmental procedures are systematized for first time, in order to be observed in whole expansion of coal thermoelectric generator park. The conception of power plants and site studies of their useful lives are also included. (C.M.). 19 figs, 24 tabs.

23021 (NEDO-C–9201) **Subsidies for promotion of coal production/utilization technology. First Clean Coal Technology Conference.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1993. 127p. (In Japanese). Order Number DE95790774. Source: OSTI; NTIS; Available from New

Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

This is a proceedings of the first Clean Coal Technology (CCT) Conference. The conference was held among scholars/men of experience, coal-related organizations, and the competent authorities to discuss NEDO's role such as CCT-related international cooperation, technology development, and system arrangement for technology transfer. In 1992, the CCT Center was established. What the center is conscious of as its subject are NEDO's overseas cooperation in CCT, how to promote clean coal utilization as technology including energy-saving generally, and how to image the future coal industry. As reference for discussion, data were distributed on transfer of the coal policy viewed from a coal utilization aspect, a system diagram for classification of the coal-related technology, a table of the coal-related technology system, the present status and development of CCT in NEDO, international cooperation through CCT. Since it is indispensable to depend on coal with the increasing energy demand in developing countries, a lot of discussions were made on coal handling, sulfur content, the CO2 problem, improvement of combustion efficiency, construction of model plants, etc.

23022 (NEDO-C–9332) **Feasibility study on the environment harmony type coal utilization system. Feasibility study on the environment harmony type coal utilization system in the coal industry sector for China.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Jun 1994. 127p. (In Japanese). Order Number DE95790787. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

Coal engineers were sent to China, and field surveys/seminars were conducted and advice was provided to them on technologies of combustion, environment and coal briquette. In China, they already know the knowledge of environmental technology of Japan, however it is necessary for them to develop inexpensive technology because of their financial difficulties. For treatment of flue gas, a water-curtain type dust arrester is installed, and the dust is at an approximately 100-150 mg/m^3 level. PH treatment is hardly given to the waste water. It is better to use this dust arrester for flue gas desulfurization and to remodel it to the one having functions of desulfurization and dust collecting. In the cogeneration plant, its main purpose is heat supply and its operational rate is low. It is desirable to take measures for promotion of energy saving such as adoption of a bleeder turbine and a system for purchase of electricity. In the heat supply, heat loss is enormous. It seems that the low fuel cost retards improvement of energy efficiency. As to coal briquette technology, they are very eager to widely spread briquette compounded with desulfurizing agent, and are interested in the high-pressure briquetting machine of Japan. 34 figs.

0110 Reserves, Geology, and Exploration

Refer also to citation(s) 23115

0120 Mining

Refer also to citation(s) 23090, 23112

23023 (ETDE-DE–143) **Environmentally friendly flexible drive concept for hard coal mining. Final report.** Schlichter (comp.); Jung (comp.). Saarbergwerke AG, Saarbruecken (Germany). Produktbereich Zentrale Dienste. Oct 1991. 21p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0326659A. Order Number DE95791352. Source: OSTI; NTIS (US Sales Only).

In the period from 1.3.89 to 30.6.91, Saarbergwerke AG in collaboration with the firm of MMBT were to test in working conditions and evaluate economically the drive components protected against an explosive atmosphere, consisting of two permanent magnet motors and associated power electronics, as a double motor drive on a cable railway machine. An inherently safe control permitted for use underground was to be developed for initiating and monitoring the drive and its braking device, and to measure the operating conditions and monitor the railway track, and this was to be adapted for the 2 motor drive above ground. Finally, the drive and control units were to be tested and optimized in two years' use. The accompanying technical measurements of the experimental use by the DMT Company for Research and Testing GmbH were to supply the basis for assessing the alternative drive concept. (orig.)

23024 (ETDE-DE–170) **Coal mining situation in the Federal Republic of Germany. First quarter 1995.** Statistik der Kohlenwirtschaft e.V., Essen (Germany). 26 May 1995. 15p. (In German). Order Number DE95795752. Source: OSTI; NTIS (US Sales Only).

The report provides up-to-date information on the German coal mining industry for the reporting time period. Data on coal mining as well as on brown coal mining cover: Production, stocks, productivity, employees, sales, imports and exports of coal and coal products. (HS)

0130 Transport, Handling, and Storage

23025 (DOE/PC/91297–T10) **A computational model for coal transport and combustion. Final technical report.** Ahmadi, G. Clarkson Univ., Potsdam, NY (United States). Mar 1995. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91297. Order Number DE95016287. Source: OSTI; NTIS; GPO Dep.

In this project, a comprehensive theoretical, computational and experimental study directed toward providing a fundamental understanding of particulate flows as applied to coal transport is performed. Thermodynamically admissible constitutive expressions for the phasic stress tensors, heat and fluctuation energy flux vectors for turbulent multiphase flows were derived. The material parameters of the model were evaluated from the limiting conditions of rapid flows of dry spherical granular particles, and single-phase turbulent fluid flows. The case of simple shear flows of glass beads-water mixtures was studied. The model was extended to cover chemically active gas-solid flows. A thermodynamically consistent model for rapid flows of granular materials in a rotating frame of reference, along with a transport equation for the granular kinetic stress tensor was developed. The model parameters for the special case of spherical nearly elastic particles were evaluated. The results for the granular stresses and the normal stress differences were compared with the available simulation data and good agreement was observed. Effects of frictional loss of energy on rapid granular shear flows were studied. The previously developed kinetic based model was used and the mean velocity, the fluctuation kinetic energy and the solid volume fraction profiles were evaluated under a variety of conditions and different friction coefficients. A computational model for analyzing rapid granular in complex geometries was developed. The discrete element scheme was used and the granular flow down a chute was analyzed. The results were compared with the available experimental data, the model predictions, and the existing simulation results, and good agreements were observed. The model was used to analyze granular flows in a duct with an obstructing block. The effect of boundary condition was also included and the granular gravity flow was analyzed in details.

23026 (DOE/PC/92578–T8) **Coal log pipeline research at the University of Missouri. 1st Quarterly report for 1995, January 1, 1995–March 31, 1995.** Liu, H. Missouri Univ., Columbia, MO (United States). [1995]. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93PC92578. Order Number DE95015611. Source: OSTI; NTIS; GPO Dep.

Work continued on the study of coal log pipeline research. Individual projects described include fast compaction of coal logs; effect of cooling on coal log quality; coal log capping; effectiveness of adding fiber to enhance coal log quality; fabrication using hydrophobic binders; cost estimation of different lubricants; automatic control of coal log pipeline system; CLP design; coal log train transport; economics of coal log pipeline; legal aspects; heating, cooling, and drying of logs; vacuum systems to enhance production; design; and effect of piston modification on capping.

0140 Combustion

Refer also to citation(s) 23518, 23944, 23974

23027 (CONF-941089–Vol.2, pp. 621-646) **Clean coal and heavy oil technologies for gas turbines.** Todd, D.M. (GE Industrial & Power Systems, Schenectady, NY (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

Global power generation markets have shown a steady penetration of GT/CC technology into oil and gas fired applications as the technology has matured. The lower cost, improved reliability and efficiency advantages of combined cycles can now be used to improve the cost of electricity and environmental acceptance of poor quality fuels such as coal, heavy oil, petroleum coke and waste products. Four different technologies have been proposed, including slagging combustors, Pressurized Fluidized Bed Combustion (PFBC), Externally Fired Combined Cycle (EFCC) and Integrated Gasification Combined Cycle (IGCC). Details of the technology for the three experimental technologies can be found in the appendix. IGCC is now a commercial technology. In the global marketplace, this shift is being demonstrated using various gasification technologies to produce a clean fuel for the combined cycle. Early plants in the 1980s demonstrated the technical/environmental features and suitability for power generation plants. Economics, however, were disappointing until the model F GT technologies were first used commercially in 1990. The economic break-through of matching F technology gas turbines with gasification was not apparent until 1993 when a number of projects were ordered for commercial operation in the mid-1990s. GE has started 10 new projects for operation before the year 2000. These applications utilize seven different gasification technologies to meet specific application needs. Early plants are utilizing low-cost fuels, such as heavy oil or petroleum coke, to provide economics in first-of-a-kind plants. Some special funding incentives have broadened the applications to include power-only coal plants. Next generation gas turbines projected for commercial applications after the year 2000 will contribute to another step change in technology. It is expected that the initial commercialization process will provide the basis for clear technology choices on future plants.

23028 (DOE/MC/21023–4008-Vol.1) **Second generation pressurized fluidized-bed combustion (PFBC) research and development, Phase 2 – Task 4, carbonizer testing. Volume 1, Test results.** Froehlich, R.; Robertson, A.; Vanhook, J.; Goyal, A.; Rehmat, A.; Newby, R. Foster Wheeler Development Corp., Livingston, NJ (United States). Nov 1994. 334p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC21023. Order Number DE95000080. Source: OSTI; NTIS; GPO Dep.

During the period beginning November 1991 and ending September 1992, a series of tests were conducted at Foster Wheeler Development Corporation in a fluidized-bed coal carbonizer to determine its performance characteristics. The carbonizer was operated for 533 hours in a jetting fluidized-bed configuration during which 36 set points (steady-state periods) were achieved. Extensive data were collected on the feed and product stream compositions, heating values, temperatures, and flow rates. With these data, elemental and energy balances were computed to evaluate and confirm accuracy of the data. The carbonizer data were not as self-consistent as could be desired (balance closure imperfection). A software package developed by Science Ventures, Inc., of California, called BALAID, was used to reconcile the carbonizer data; the details of the reconciliation have been given in Volume 1 of this report. The reconciled data for the carbonizer were rigorously analyzed, correlations were developed, and the model was updated accordingly. The model was then used in simulating each of the 36 steady-state periods achieved in the pilot plant. The details are given in this Volume of the report.

23029 (DOE/MC/21023–4008-Vol.2) **Second generation pressurized fluidized-bed combustion (PFBC) research and development, Phase 2 — Task 4, carbonizer testing. Volume 2, Data reconciliation.** Froehlich, R.; Robertson, A.; Vanhook, J.; Goyal, A.; Rehmat, A.; Newby, R. Foster Wheeler Development Corp., Livingston, NJ (United States). Nov 1994. 801p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC21023. Order Number DE95014418. Source: OSTI; NTIS; GPO Dep.

During the period beginning November 1991 and ending September 1992, a series of tests were conducted at Foster Wheeler Development Corporation in a fluidized-bed coal carbonizer to determine its performance characteristics. The carbonizer was operated for 533 hours in a jetting fluidized-bed configuration during which 36 set points (steady-state periods) were achieved. Extensive data were collected on the feed and product stream compositions, heating values, temperatures, and flow rates. With these data, elemental and energy balances were computed to evaluate and confirm accuracy of the data. The carbonizer data were not as self-consistent as could be desired (balance closure imperfection). A software package developed by Science Ventures, Inc., of California, called BALAID, was used to reconcile the carbonizer data; the details of the reconciliation have been given in Volume 1 of this report. The reconciled data for the carbonizer were rigorously analyzed, correlations were developed, and the model was updated accordingly. The model was then used in simulating each of the 36 steady-state periods achieved in the pilot plant. The details are given in this Volume one. This Volume 2 provides details of the carbonizer data reconciliation.

23030 (DOE/MC/27229–4055) **Pulsed atmospheric fluidized bed combustion. Technical progress report, January 1995–April 1995.** Thermochem, Inc., Columbia, MD (United States). 31 May 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-90MC27229. Order Number DE95014976. Source: OSTI; NTIS; GPO Dep.

Progress is reported on the design of a pulsed fluidized bed combustor and component, fabrication, and construction site activities.

23031 (DOE/PC/79650–T48) **CWS-fired residential warm-air heating system. Quarterly report, January 22, 1987–April 30, 1987.** Becker, F.E.; Smolensky, L.A.; McPeak, M.A. Thermo Electron Corp., Waltham, MA (United States). May 1987. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79650. Order Number DE95015542. Source: OSTI; NTIS; GPO Dep.

The objective of this project is the development of a coal water slurry burning residential furnace. A literature survey has been performed. Also, the preliminary testing of prototype components was carried out. Design criteria and specifications are discussed.

23032 (DOE/PC/79903–T19-Vol.1) **Optical properties of fly ash. Volume 1, Final report.** Self, S.A. Stanford Univ., CA (United States). High Temperature Gasdynamics Lab. Dec 1994. 299p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79903. Order Number DE95016152. Source: OSTI; NTIS; GPO Dep.

Research performed under this contract was divided into four tasks under the following headings: Task 1, Characterization of fly ash; Task 2, Measurements of the optical constants of slags; Task 3, Calculations of the radiant properties of fly ash dispersions; and Task 4, Measurements of the radiant properties of fly ash dispersions. Tasks 1 and 4 constituted the Ph.D. research topic of Sarbajit Ghosal, while Tasks 2 and 3 constituted the Ph.D. research topic of Jon Ebert. Together their doctoral dissertations give a complete account of the work performed. This final report, issued in two volumes consists of an executive summary of the whole program followed by the dissertation of Ghosal. Volume 1 contains the dissertation of Ghosal which covers the characterization of fly ash and the measurements of the radiant properties of fly ash dispersions. A list of publications and conference presentations resulting from the work is also included.

23033 (DOE/PC/79903–T19-Vol.2) **Optical properties of fly ash. Volume 2, Final report.** Self, S.A. Stanford Univ., CA (United States). High Temperature Gasdynamics Lab. Dec 1994. 293p.

Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79903. Order Number DE95016153. Source: OSTI; NTIS; GPO Dep.

Research performed under this contract was divided into four tasks under the following headings: Task 1, Characterization of fly ash; Task 2, Measurements of the optical constants of slags; Task 3, Calculations of the radiant properties of fly ash dispersions; and Task 4, Measurements of the radiant properties of fly ash dispersions. Tasks 1 and 4 constituted the Ph.D. research topic of Sarbajit Ghosal, while Tasks 2 and 3 constituted the Ph.D. research topic of Jon Ebert. Together their doctoral dissertations give a complete account of the work performed. This final report, issued in two volumes consists of an executive summary of the whole program followed by the dissertation of Ghosal and Ebert. Volume 2 contains the dissertation of Ebert which covers the measurements of the optical constants of slags, and calculations of the radiant properties of fly ash dispersions. A list of publications and conference presentations resulting from the work is also included.

23034 (DOE/PC/88697–T11) **Coal-water slurry fuel combustion testing in an oil-fired industrial boiler. Semiannual technical progress report, August 15, 1994–February 15, 1995.** Miller, B.G. Pennsylvania State Univ., University Park, PA (United States). Energy and Fuels Research Center. 12 May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-89PC88697. Order Number DE95015608. Source: OSTI; NTIS; GPO Dep.

The Pennsylvania State University is conducting a coal-water slurry fuel (CWSF) program for the United States Department of Energy (DOE) and the Commonwealth of Pennsylvania with the objective of determining the viability of firing CWSF in an industrial boiler designed for heavy fuel oil. Penn State and DOE have entered into a cooperative agreement to determine if CWSFs prepared from cleaned coal (containing approximately 3.5 wt.% ash and 0.9 wt.% sulfur) can be burned effectively in a heavy fuel oil-designed industrial boiler without adverse impact on boiler rating, maintainability, reliability, and availability. The project will also provide information to help in the design of new systems specifically configured to fire these clean coal-based fuels. The project consists of four phases: (1) design, permitting, and test planning, (2) construction and start up, (3) demonstration and evaluation (1,000-hour demonstration), and (4) expanded demonstration and evaluation (installing a CWSF preparation circuit, conducting an additional 1,000 hours of testing, and installing an advanced flue gas treatment system). The boiler testing and evaluation will determine if the CWSF combustion characteristics, heat release rate, fouling and stagging behavior, corrosion and erosion tendencies, and fuel transport, storage, and handling characteristics can be accommodated in a boiler system designed to fire heavy fuel oil. In addition, the proof-of-concept demonstration will generate data to determine how the properties of a CWSF and its parent coal affect boiler performance. The economic factors associated with retrofitting boilers will also be evaluated. The first three phases (i.e., the first demonstration) have been completed and the combustion performance of the burner that was provided with the boiler did not meet performance goals. Consequently, the first demonstration has been concluded at 500 hours.

23035 (DOE/PC/90278–T1) **Development of a coal fired pulse combustor for residential space heating. Technical progress report, October–December 1986.** Management and Technical Consultants, Inc., Columbia, MD (United States). [1986]. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90278. Order Number DE95016147. Source: OSTI; NTIS; GPO Dep.

This progress report presents a detailed description of the background, technology and application, and Statement of Work for the development of a coal-fired pulse combustor for residential space heating.

23036 (DOE/PC/90278–T2) **Development of a coal fired pulse combustor for residential space heating. Technical progress report, January–March 1987.** Management and Technical Consultants, Inc., Columbia, MD (United States). [1987]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90278. Order Number DE95016146. Source: OSTI; NTIS; GPO Dep.

The systematic development of the residential combustion system is divided into three phases. Only Phases I and II are detailed here. Phase I constitutes the design, fabrication, testing, and evaluation of a pulse combustor sized for residential space heating. Phase II is an optional phase to develop an integrated system including a heat exchanger. Phase III is projected as a field test of the integrated coal-fired residential space heater. The program logic is depicted in Figure 3-1. The objective of Phase I is to develop an ' advanced pulse coal combustor at the 100,000 Btu/hr scale which can later be integrated with a heat exchanger and controls to form a residential space heater. Phase I is comprised of four technical tasks which are described. The initial test fuels for the Phase I and II effort were expected to be coal slurries. However, it soon became obvious that the availability of the slurries during the development stage would be somewhat problematic and could become an impediment to maintaining progress and schedule. It was therefore decided, after discussions with the DOE Project Manager, to focus the Phase I and II effort upon the use of dry micronized coal and to consider the slurries for a product improvement activity in later phases of the program. This change will not affect the cost, schedule, or technical objectives of the Statement of Work.

23037 (DOE/PC/90278–T3) **Development of a coal fired pulse combustor for residential space heating. Technical progress report, April–June 1987.** Management and Technical Consultants, Inc., Columbia, MD (United States). [1987]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90278. Order Number DE95016145. Source: OSTI; NTIS; GPO Dep.

During this period, advanced chambers were fabricated and tested in both single and tandem configurations. A scrubber was designed, constructed, installed in the facility, and checked-out. The dry pulverized coal and micronized coal water mixtures have been supplied by Energy International. Optimization of the configuration continued with respect to fuel phasing, slag handling characteristics, and tailpipe coupling.

23038 (DOE/PC/90278–T4) **Development of a coal fired pulse combustor for residential space heating. Technical progress report, July–September 1987.** Management and Technical Consultants, Inc., Columbia, MD (United States). [1987]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90278. Order Number DE95016144. Source: OSTI; NTIS; GPO Dep.

The systematic development of the residential combustion system is divided into three phases. Only Phase I is detailed here. Phase I constitutes the design, fabrication, testing, and evaluation of a pulse combustor sized for residential space heating. Phase II is an optional phase to develop an integrated system including a heat exchanger. Phase III is projected as a field test of the integrated coal-fired residential space heater. The Phase I effort was nearing completion during this reporting period and a final report is in preparation. The configuration testing was completed early in the period and based upon results of the configuration tests, an optimized configuration for the experimental development testing was chosen. The refractory-lined chambers were fabricated and tested from mid-September through early October. The tandem unit was operated on dry micronized coal without support gas or excitation air for periods lasting from one to three hours. Performance was stable and turndown ratios of 3:1 were achieved during the first three-hour test. A early commercial residential heating system configuration has been identified on the basis of the development testing conducted throughout the first phase of this effort. The development effort indicates that the residential unit goals are achievable with some additional product improvement effort to increase carbon burn-out efficiency, reduce CO emissions and develop a reliable and compact dry, ultrafine coal feed system (not included in the present effort).

23039 (DOE/PC/90278–T5) **Development of a coal fired pulse combustor for residential space heating: Phase 1-A. Technical progress report, June–August 1988.** Management and Technical Consultants, Inc., Columbia, MD (United States). Oct 1988. 37p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC22-86PC90278. Order Number DE95016143. Source: OSTI; NTIS; GPO Dep.

The systematic development of the residential combustion system is divided into three phases. Only Phases I and IA are detailed here. Phase I constitutes the design, fabrication, testing, and evaluation of a pulse combustor sized for residential space heating. Phase IA includes additional testing with coal-water slurries and the design and evaluation of integrated systems using dry micronized coal and slurry. Phase II is an optional phase to develop an integrated system including a heat exchanger. Phase III is projected as a field test of the integrated coal-fired residential space heater. During this period, a combustor test bed was designed and fabricated to provide experimental resolution for the primary technical issues necessary to design and fabricate a fully integrated and optimized unit. A preliminary integrated design was also prepared and analytic models developed to simulate both steady-state performance and transient response during start-up and periodic cycling. The combustor test bed, ancillary facility components (including the wet cyclone scrubber), and sampling train were installed. Shakedown tests of the test bed were also initiated and a test plan is being prepared.

23040 (DOE/PC/92159–T12) **Engineering development of advanced coal-fired low-emission boiler systems. Technical progress report No. 10, January 1995–March 1995.** Combustion Engineering, Inc., Windsor, CT (United States). Power Plant Labs. 17 May 1995. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92159. Order Number DE95015619. Source: OSTI; NTIS; GPO Dep.

The project is on schedule and under budget. The current status is shown in the Milestone Schedule Report included as Appendix A. All Project Plans were updated based on the revised finding level authorized for FY95 and anticipated for FY96. Technology Transfer activities included "supplying" three executives and several team members to the LEBS Workshop, delivering a technical paper at a conference, and working on a Combustion 2000 Session for another conference. ABBES and CeraMem reached agreement concerning Task 7 work, including ownership and disposition of project-purchased equipment to be used during Task 7 and also during Task 11. A test plan was prepared. Task 7 activities for the Low-NO_x Firing System included computational modeling of the firing arrangement. Reasonable comparisons to experimental data previously obtained in the Boiler Simulation Facility were achieved. A kinetic evaluation for both baseline and low NO_x firing arrangements was also performed, with results indicating that the final reducing zone within the main windbox has a dominant effect on NO_x reduction, with higher temperatures being more favorable for lower NO_x. A week of combustion testing was completed in the Fundamental Scale Burner Facility to examine the impact of integrated fuel staging (NO_x reduction via the reburn mechanism), and to explore preliminary vertical staging concepts within the main windbox region. Preliminary results from this testing demonstrated the potential of vertical air staging within the main windbox to augment overfire air. Testing was performed to quantify the coal size distribution and power requirements for one (1) conventional static and four (4) dynamic classifier designs. Results from this testing show the dynamic classifier capable of producing finer grinds of coal at lower relative power requirements.

23041 (DOE/PC/94116–T4) **Emissions reductions in coal-fired home heating stoves through use of briquettes. Quarterly report, January 1, 1995–March 31, 1995.** Acurex Environmental Corp., Research Triangle Park, NC (United States). 27 Apr 1995. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-94PC94116. Order Number DE95015609. Source: OSTI; NTIS; GPO Dep.

The purpose of this program is to encourage the formation of commercial ventures between the U.S. and Polish firms to provide equipment and /or services to reduce pollution from low emission sources in Krakow, Poland. This period has seen additional briquette testing at Akademia Gorniczo Hutnicza (AGH). In addition, Euromining has begun large-scale briquette production. The initial multi-ton batches were delivered as this period ended. Acurex Environmental Corporation has delivered a sampling crew and equipment to Krakow. Testing at INCO Veritas (INCO) has not started due to delays in the delivery of briquettes by Euromining but is expected to begin with the new quarter. Arrangements are in place for the product market testing to begin as soon as the briquettes are available.

23042 (DOE/PC/94122–T2) **Combustion characterization of coal fines recovered from the handling plant. Quarterly technical progress report No. 2, January 1, 1995–March 31, 1995.** Houshang, Masudi. Prairie View A and M Univ., TX (United States). Apr 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-94PC94122. Order Number DE95015536. Source: OSTI; NTIS; GPO Dep.

The main goal of this research project is to evaluate the combustion characteristics of the slurry fuels prepared from the recovered coal fines and plant coal fines. A specific study will include the combustion behavior, flame stability, ash behavior and emissions of SO_x, NO_x and particulate in a well insulated laboratory scale furnace in which the residence time and temperature history of the burning particles are similar to that of utility boiler furnace at 750,000 Btu/hr input and 20% excess air. The slurry fuel will be prepared at 60% solid to match the generic slurry properties, i.e., viscosity less than 500 cp, 100% of particles passing through 100 mesh and 80-90% of solid particles passing through 200 mesh. The coal blend is prepared using a mix of 15% effluent recovered coal and 85% plant fines. Combustion characteristics of the slurry fuels is determined at three different firing rates 750K, 625K, 500K Btu/hr. Finally a comparison of the results is made to determine the advantages of coal water slurry fuel over the plant coal blended form.

23043 (SAND–95-8234) **The release of iron during coal combustion. Milestone report.** Baxter, L.L. (Sandia National Labs., Livermore, CA (United States). Combustion Research Facility). Sandia National Labs., Livermore, CA (United States). Jun 1995. 88p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015267. Source: OSTI; NTIS; GPO Dep.

Iron plays an important role in the formation of both fly ash and deposits in many pulverized-coal-fired boilers. Several authors indicate that iron content is a significant indicator of the slagging propensity of a majority of US bituminous coals, in particular eastern bituminous coals. The pyritic iron content of these coals is shown to be a particularly relevant consideration. A series of investigations of iron release during combustion is reported for a suite of coals ranging in rank from lignite to low-volatile bituminous coal under combustion conditions ranging from oxidizing to inert. Experimental measurements are described in which, under selected conditions, major fractions of the iron in the coal are released within a 25 ms period immediately following coal devolatilization. Mechanistic interpretation of the data suggest that the iron is released as a consequence of oxygen attack on porous pyrrhotite particles. Experimental testing of the proposed mechanism reveals that the release is dependent on the presence of both pyrite in the raw coal and oxygen in the gas phase, that slow preoxidation (weathering) of the pyrite significantly inhibits the iron release, and that iron loss increases as oxygen penetration of the particle increases. Each observation is consistent with the postulated mechanism.

23044 (SAND–95-8250) **Coal char fragmentation during pulverized coal combustion.** Baxter, L.L. Sandia National Labs., Albuquerque, NM (United States). Jul 1995. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015841. Source: OSTI; NTIS; GPO Dep.

A series of investigations of coal and char fragmentation during pulverized coal combustion is reported for a suite of coals ranging in rank from lignite to low-volatile (lv) bituminous coal under combustion conditions similar to those found in commercial-scale boilers. Experimental measurements are described that utilize identical particle sizing characteristics to determine initial and final size distributions. Mechanistic interpretation of the data suggest that coal fragmentation is an insignificant event and that char fragmentation is controlled by char structure. Chars forming cenospheres fragment more extensively than solid chars. Among the chars that fragment, large particles produce more fine material than small particles. In all cases, coal and char fragmentation are seen to be

sufficiently minor as to be relatively insignificant factors influencing fly ash size distribution, particle loading, and char burnout.

23045 (SAND–95-8251) **Coal combustion science. Quarterly progress report, April 1994–June 1994.** Hardesty, D.R. (ed.); Baxter, L.L.; Davis, K.A. Sandia National Labs., Albuquerque, NM (United States). Jul 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015842. Source: OSTI; NTIS; GPO Dep.

Research on coal combustion continued. This report presents results on: kinetics and mechanisms of coal char combustion, and deposit growth and property development in coal-fired furnaces.

23046 (SAND–95-8252) **Release of inorganic material during coal devolatilization. Milestone report.** Baxter, L.L. Sandia National Labs., Albuquerque, NM (United States). Jul 1995. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015843. Source: OSTI; NTIS; GPO Dep.

Experimental results presented in this paper indicate that coal devolatilization products convectively remove a fraction of the nonvolatile components of inorganic material atomically dispersed in the coal matrix. Results from three facilities burning six different coals illustrate this mechanism of ash transformation and release from coal particles. Titanium is chosen to illustrate this type of mass release from coal particles on the basis of its low volatility and mode of occurrence in the coal. During moderate rates of devolatilization (10^4 K/s heating rate), no significant loss of titanium is noted. At more rapid rates of heating/devolatilization (10^5 K/s) a consistent but minor (3-4 %) loss of titanium is noted. During rapid devolatilization ($5x10^5$ K/s and higher), significant (10-20 %) amounts of titanium leave the coal. The loss of titanium monitored in coals ranging in rank from subbituminous to high-volatile bituminous coals and under conditions typical of pulverized-coal combustion. The amount of titanium lost during devolatilization exhibits a complex rank dependence. These results imply that other atomically dispersed material (alkali and alkaline earth elements) may undergo similar mechanisms of transformation and release.

0150 Economic, Industrial, and Business Aspects

Refer also to citation(s) 23021, 23022, 23024, 23100

23047 (ETDE-BR–0017) **Planning the mineral coal supply in Brazil: the MOCAM model and its applications.** Tourinho, Octavio A.F.; Margulis, Sergio; Ardeo, Vagner Laerte. Instituto de Planejamento Economico e Social (IPES), Rio de Janeiro, RJ (Brazil). Inst. de Pesquisas. Mar 1985. 272p. (In Portugese). Order Number DE95789961. Source: OSTI; NTIS (US Sales Only).

Serie textos para discussao. Grupo de energia no. 29.

The cost of Brazilian mineral coal for consumption is the result of factors related to several aspects of mining, processing and transport alternatives. A planning model to evaluate these alternatives is developed, including the activities of coal flux called MOCAM (Mineral Coal Model). This study shows how the MOCAM can be used as an instrument for planning, giving examples for the analysis of some political questions. The characterization of the three factors (mining, processing and transport) on the coal supply is described, discussing the qualitative aspects for planning and the main technical and economical parameters used in this modelling. An evaluation of the environmental problems in coal production and consumption and the present state of environment in Brazil, concerning the mineral coal are also presented. Finally some political questions about mineral coal supply, mentioning the economy of the transport and analysing the solution in relation to the demand and the fuel oil price are cited. 76 refs, 37 figs, 66 tabs

23048 (ETDE-BR–0018) **The energy consumption in the lime industry in Minas Gerais state, Brazil.** Companhia Energetica de Minas Gerais (CEMIG), Belo Horizonte, MG (Brazil). Oct 1991. 256p. (In Portugese). Order Number DE95789962. Source: OSTI; NTIS (US Sales Only).

The main characteristics in the lime industry during the years 1980/1987 in Minas Gerais, Brazil are shown including the increase of installed capacity, the growth of energy consumption and the use of firewood and fuel oil as the main energy source. An evaluation of the calcination furnaces used by the producers in 1985, taking into consideration the aspects of energy consumption and energy conservation is also described. 74 refs, 44 figs, 31 tabs

0160 Health and Safety

23049 (ETDE-DE–153) **Branch project mining industry: Development of a system for epidemiological analyses in the occupational medicine (SEPIA). Appendix. SEPIA-AMD manual. Final report.** Piekarski, C. Ruhrkohle AG, Essen (Germany). Jan 1995. 181p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 01HD010. Order Number DE95790758. Source: OSTI; NTIS (US Sales Only).

The "SEPIA" project (system for epidemiological analyses in occupational medicine) was developed by the company physicians of Ruhrkohle AG in cooperation with the institute of ergonomics. It represents a uniform procedure for medical checks in the black-coal mining sector in accordance with the plan of the superior board of mines of North-Rhine-Westphalia, which has been adopted by all members of the medical services of Ruhrgas. At each of these consulting rooms, data obtained by occupational-medical checks are systematically compiled and stored for a long time; epidemiologically relevant data material is gathered and evaluated. (orig./HS)

02 PETROLEUM

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 23077, 23083, 23966

23050 (DOE/BC/14649–8) **Analysis and evaluation of interwell seismic logging techniques for reservoir characterization. [Quarterly report], April 1–June 30, 1992.** Parra, J.O. Southwest Research Inst., San Antonio, TX (United States). [1992]. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90BC14649. Order Number DE95015485. Source: OSTI; NTIS; GPO Dep.

The objective of this three-year research program is to investigate interwell seismic logging techniques for indirectly interpreting oil and gas reservoir geology and pore fluid permeability. This work involves a balanced study of advanced theoretical and numerical modeling of seismic waves transmitted between pairs of reservoir wells combined with experimental data acquisition and processing of measurements at controlled sites as well as in full-scale reservoirs. This reservoir probing concept is, aimed at demonstrating unprecedented high-resolution measurements and detailed interpretation of heterogeneous hydrocarbon-bearing formations. Part of the numerical model task is to investigate the sensitivity of the in-situ rock-physical properties of the formation such as porosity and permeability on three-component seismograms, and the pressure, as well as phase velocity and attenuation. For this purpose we have developed software to simulate synthetic seismograins associated with a point-source (compressional wave), and a point force (shear wave), in stratified fluid-filled porous media. In addition, we have developed software to calculate phase velocity and attenuation from interwell seismic waveforms. To demonstrate the use of these capabilities we present examples to simulate seismograms and dispersion and attenuation curves.

23051 (DOE/BC/14649–9) **Analysis and evaluation of interwell seismic logging techniques for reservoir characterization. [Quarterly report], July 1–September 30, 1992.** Parra, J.O. Southwest Research Inst., San Antonio, TX (United States). [1992]. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90BC14649. Order Number DE95015484. Source: OSTI; NTIS; GPO Dep.

The objective of this three-year research program is to investigate interwell seismic logging techniques for indirectly interpreting oil and gas reservoir geology and pore fluid permeability. This work involves a balanced study of advanced theoretical and numerical modeling of seismic waves transmitted between pairs of reservoir

wells combined with experimental data acquisition and processing of measurements at controlled sites as well as in full-scale reservoirs. This reservoir probing concept is aimed at demonstrating unprecedented high-resolution measurements and detailed interpretation of heterogeneous hydrocarbon-bearing formations. Progress reports are presented by Task 3 conduct full-scale experimental field test and Task 4 data processing studies. For Task 3, interwell seismic experiments were conducted in the month of September at the University of Oklahoma Gypsy test site which is located in Pawnee County, Oklahoma. During the field test a full suite of interwell seismic data were acquired and will be used to extract rock porosity and permeability. In particular, interwell seismic experiments were conducted using two borehole hydrophone arrays (streamers) consisting of twelve detector channels (i.e., simultaneous source-to-detector measurements were made in two boreholes pairs having different separation distances) for source-independent seismic attenuation and dispersion studies.

23052 (DOE/BC/14649–11) **Analysis and evaluation of interwell seismic logging techniques for reservoir characterization. [Quarterly report], January 1–March 31, 1993.** Parra, J.O. Southwest Research Inst., San Antonio, TX (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90BC14649. Order Number DE95015483. Source: OSTI; NTIS; GPO Dep.

The objective of this three-year research program is to investigate interwell seismic logging techniques for indirectly interpreting oil and gas reservoir geology and pore fluid permeability. This work involves a balanced study of advanced theoretical and numerical modeling of seismic waves transmitted between pairs of reservoir wells combined with experimental data acquisition and processing of measurements at controlled sites as well as in full-scale reservoirs. This reservoir probing concept is aimed at demonstrating unprecedented high-resolution measurements and detailed interpretation of heterogeneous hydrocarbon-bearing formations. Technical progress for the past quarter is summarized for Task 3, data processing and analysis of geological and petrophysical analysis of the interval from 800 to 1100 feet in five wells at the Gypsy Test Site.

23053 (DOE/BC/14649–12) **Analysis and evaluation of interwell seismic logging techniques for reservoir characterization. [Quarterly report], April 1–June 30, 1993.** Parra, J.O. Southwest Research Inst., San Antonio, TX (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90BC14649. Order Number DE95015482. Source: OSTI; NTIS; GPO Dep.

The objective of this three-year research program is to investigate interwell seismic logging techniques for indirectly interpreting oil and gas reservoir geology and rock physical properties. This work involves a balanced study of advanced theoretical and numerical modeling of seismic waves transmitted between pairs of reservoir wells combined with experimental dam acquisition and processing of measurements at controlled sites as well as in full-scale reservoirs. This reservoir probing concept is aimed at demonstrating high-resolution measurements and detailed interpretation of heterogeneous hydrocarbon-bearing formations. In this quarterly report technical progress is summarized for Task 3, data processing and analysis of: preliminary interpretation of interwell seismic data from wells 5-7 and 7-7 at the Gypsy Test Site; and the response of a thin layer in an anistropic shale.

23054 (DOE/BC/14891–7) **Interdisciplinary study of reservoir compartments. Quarterly technical progress report, January 1, 1995–March 31, 1995.** Van Kirk, C.W. Colorado School of Mines, Golden, CO (United States). Dept. of Petroleum Engineering. 27 Apr 1995. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93BC14891. Order Number DE95014951. Source: OSTI; NTIS; GPO Dep.

This program was established to document the integrated team approach for solving reservoir engineering problems. Investigations were carried out in the areas of structural mapping of geologic faults, and petrophysical parameters coupled with the geologic fault interpretations and production data to interpret the sealing of the faults.

23055 (DOE/BC/14892–7) **Visual display of reservoir parameters affecting enhanced oil recovery. Quarterly report, April 1995–June 1995. 2nd Quarter, FY 1995.** Wood, J.R. Michigan Technological Univ., Houghton, MI (United States). 5 Apr 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93BC14892. Order Number DE95014956. Source: OSTI; NTIS; GPO Dep.

This report describes the development of a Spatial Database Manager (SDBM) shell/interface which will provide information to users on how to collect, store, analyze, interpret, visualize and present data in an integrated reservoir characterization study. SDBM will provide access to various geologic, reservoir visual data via a well log interpretation program (Crocker Petrolog), mapping and cross section software (the GeoGraphix Exploration System Workbench) and a volume visualization application. Data tables for geochemical and petrographic data, well logs, well header information, well production data, formation tops, and fault trace data have been completed. Spectral mineral data are currently being collected which will ultimately be used for identification of mineral assemblages. The geochemical program CHILLER is being used to model fluid-rock interactions and possibly porosity predictions.

23056 (DOE/BC/14896–6) **Geological and petrophysical characterization of the Ferron Sandstone for 3-D simulation of a fluvial-deltaic reservoir. Annual report, September 29, 1993–September 29, 1994.** Allison, M. Utah Dept. of Natural Resources, Salt Lake City, UT (United States). Geological Survey Div. Jul 1995. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93BC14896. Order Number DE95000172. Source: OSTI; NTIS; GPO Dep.

The objective of the Ferron Sandstone project is to develop a comprehensive, interdisciplinary, quantitative characterization of a fluvial-deltaic reservoir to allow realistic inter-well and reservoir-scale models to be developed for improved oil-field development in similar reservoirs world-wide. Quantitative geological and petrophysical information on the Cretaceous Ferron Sandstone in east-central Utah will be collected. Both new and existing data will be integrated into a three-dimensional model of spatial variations in porosity, storativity, and tensorial rock permeability at a scale appropriate for inter-well to regional-scale reservoir simulation. Simulation results could improve reservoir management through proper infill and extension drilling strategies, reduction of economic risks, increased recovery from existing oil fields, and more reliable reserve calculations. Transfer of the project results to the petroleum industry is an integral component of the project. This report covers research activities for fiscal year 1993-94, the first year of the project. Most work consisted of developing field methods and collecting large quantities of existing and new data. We also developed preliminary regional and case-study area interpretations. The project is divided into four tasks: (1) regional stratigraphic analysis, (2) case studies, (3) development of reservoirs models, and (4) field-scale evaluation of exploration strategies.

23057 (DOE/BC/14896–7) **Geological and petrophysical characterization of the Ferron Sandstone for 3-D simulation of a fluvial-deltaic reservoir. Technical progress report, January 1, 1995–March 31, 1995.** Allison, M.L. Utah Dept. of Natural Resources, Salt Lake City, UT (United States). Geological Survey Div. 2 May 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93BC14896. Order Number DE95014952. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to develop a comprehensive, interdisciplinary, and quantitative characterization of a fluvial-deltaic reservoir which will allow realistic inter-well and reservoir-scale modeling to be developed for improved oil-field development in similar reservoirs world-wide. The geological and petrophysical properties of the Cretaceous Ferron Sandstone in east-central Utah will be quantitatively determined. Both new and existing data will be integrated into a three-dimensional representation of spatial variations in porosity, storativity, and tensorial rock permeability at a scale appropriate for inter-well to regional-scale reservoir simulation. Results could improve reservoir management through proper infill and extension drilling strategies, reduction of economic risks,

increased recovery from existing oil fields, and more reliable reserve calculations. Transfer of the project results to the petroleum industry is an integral component of the project.

23058 (DOE/BC/14953–10) **Increased oil production and reserves from improved completion techniques in the Bluebell Field, Uinta Basin, Utah. Annual report, September 30, 1993–September 30, 1994.** Allison, M. Utah Dept. of Natural Resources, Salt Lake City, UT (United States). Geological Survey Div. Jul 1995. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14953. Order Number DE95000171. Source: OSTI; NTIS; GPO Dep.

The Bluebell field produces from the Tertiary lower Green River and Wasatch Formations of the Uinta Basin, Utah. The productive interval consists of thousands of feet of interbedded fractured clastic and carbonate beds deposited in a fluvial-dominated deltaic lacustrine environment, sandstones deposited in fluvial-dominated deltas; and carbonates and some interbedded sandstones of the lower Wasatch transition deposited in mud flats. Bluebell project personnel are studying ways to improve completion techniques used in the field to increase primary production in both new wells and recompletions. The study includes detailed petrographic examination of the different lithologic reservoir types in both the outcrop and core. Outcrop, core, and geophysical logs are being used to identify and map important depositional cycles. Petrographic detail will be used to improve log calculation methods which are currently highly questionable due to varying water chemistry and clay content in the Green River and Wasatch Formations. Field mapping of fractures and their relationship to basin tectonics helps predict the orientation of open fractures in the subsurface. The project includes acquiring bore-hole imaging logs from new wells in the Bluebell field thereby obtaining detailed subsurface fracture data previously not available. Reservoir simulation models are being constructed to improve the understanding of pressure and fluid flow within the reservoir. A detailed database of well completion histories has been compiled and will be studied to determine which were the most and the least effective methods used in the past.

23059 (DOE/BC/14954–5) **Advanced secondary recovery demonstration for the Sooner Unit. Annual report, October 1992–May 1993.** Sippel, M. (and others); Junkin, J.; Pritchett, R. Diversified Operating Corp., Denver, CO (United States). Jul 1995. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14954. Order Number DE95000170. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are to demonstrate the effectiveness of a multi-diciplinary approach to targeted infill drilling and improved reservoir management. The first phase involves geophysical, geological, and engineering data acquisition and analysis to identify optimum well sites and to develop a reservoir operations plan. This report summarizes activities concerned with phase I of the Sooner Unit Project.

23060 (DOE/BC/14959–13) **Revitalizing a mature oil play: Strategies for finding and producing unrecovered oil in Frio Fluvial-Deltaic Sandstone Reservoirs of South Texas.** McRae, L.E.; Holtz, M.H.; Knox, P.R. Texas Univ., Austin, TX (United States). Jul 1995. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14959. Order Number DE95000160. Source: OSTI; NTIS; GPO Dep.

The Frio Fluvial-Deltaic Sandstone Play of South Texas is one example of a mature play where reservoirs are being abandoned at high rates, potentially leaving behind significant unrecovered resources in untapped and incompletely drained reservoirs. Nearly 1 billion barrels of oil have been produced from Frio reservoirs since the 1940's, yet more than 1.6 BSTB of unrecovered mobile oil is estimated to remain in the play. Frio reservoirs of the South Texas Gulf Coast are being studied to better characterize interwell stratigraphic heterogeneity in fluvial-deltaic depositional systems and determine controls on locations and volumes of unrecovered oil. Engineering data from fields throughout the play trend were evaluated to characterize variability exhibited by these heterogeneous reservoirs and were used as the basis for resource calculations to demonstrate a large additional oil potential remaining within the play. Study areas within two separate fields have been selected in which to apply advanced reservoir characterization techniques. Stratigraphic log correlations, reservoir mapping, core analyses, and evaluation of production data from each field study area have been used to characterize reservoir variability present within a single field. Differences in sandstone depositional styles and production behavior were assessed to identify zones with significant stratigraphic heterogeneity and a high potential for containing unproduced oil. Detailed studies of selected reservoir zones within these two fields are currently in progress.

23061 (DOE/BC/14961–7) **Department of Energy quarterly technical report.** Anderson, R.N. Columbia Univ., Palisades, NY (United States). Lamont-Doherty Earth Observatory. 15 Apr 1995. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14961. Order Number DE95016212. Source: OSTI; NTIS; GPO Dep.

The objective is to test the concept that the growth faults in Eugene Island Block 330 (EI-330 field) are conduits through which producing reservoirs are charged and that enhanced production can be developed by producing directly from the fault zone. The site, operated by Penzoil, is located in 250 feet of water and the productive depth intervals include 4000 to 9000 feet. The field demonstration will be accomplished by drilling and production testing of growth fault systems associated with the EI-330 field. The project utilizes advanced 3-D seismic analysis, geochemical studies, structural and stratigraphic reservoir characterization, reservoir simulation, compact visualization systems. In this quarterly report, progress reports are presented for the following tasks: database management; reservoir characterization; modeling; geochemistry; and data integration.

23062 (DOE/BC/14982–3) **An integrated study of the Grayburg/San Andres Reservoir, Foster and South Cowden Fields, Ector County, Texas. Quarterly technical progress report No. 3, February 1, 1995–April 30, 1995.** Reeves, J.J.; Rowland, D.A.; Trentham, R.C. Laguna Petroleum Corp., Midland, TX (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-94BC14982. Order Number DE95016213. Source: OSTI; NTIS; GPO Dep.

The objective of this study is to demonstrate a methodology for reservoir characterization of shallow shelf carbonate reservoirs which is feasible for the independent operator. Furthermore, it will provide one of the first public demonstrations of the enhancement of reservoir characterization using high resolution 3-D seismic data. This particular project will evaluate the Grayburg and San Andres reservoirs in the Foster and South Cowden Fields of Ector County, Texas. We intend to showcase a multi-disciplinary approach to waterflood design and implementation, along with the addition of reserves by selective infill drilling. We believe this approach in reservoir development will be applicable to a wide range of shallow shelf carbonate reservoirs throughout the United States. Technology transfer will take place through all phases of the project. Progress reports are presented for the following tasks: geological; reservoir engineering; and geophysics.

23063 (DOE/BC–95000151) **Multifrequency crosshole EM imaging for reservoir characterization. FY 1994 annual report.** Lee, K.H. Lawrence Berkeley Lab., CA (United States). Jun 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95000151. Source: OSTI; NTIS; GPO Dep.

Electrical conductivity of sedimentary rocks is controlled by the porosity, hydraulic permeability, temperature, saturation, and the pore fluid conductivity. These rock parameters play important roles in the development and production of hydrocarbon (petroleum and natural gas) resources. For these reasons, resistivity well logs have long been used by geologists and reservoir engineers in petroleum industries to map variations in pore fluid, to distinguish between rock types, and to determine completion intervals in wells. Reservoir simulation and process monitoring rely heavily on the physical characteristics of the reservoir model. Over a period of three years (1991-1993) there was an initial phase of crosshole EM technique development via an informal partnership between LLNL and LBL. Researchers developed field instrumentation to apply to oil field for monitoring EOR thermal processes. Specifically, a prototype single-frequency instrumentation was developed and with this system we have conducted field surveys in four separate

locations. Theory and software were developed to interpret these data by providing subsurface images of the electrical conductivity. In spite of our initial success in developing practical EM techniques, we still had severe instrumentation limitations and shortcomings in interpretation for other than simple structures. The field equipment was designed to work only at a single frequency at a time and the transmitter must be opened to change frequencies. The equipment was also significantly noiser at higher frequencies. For high-resolution applications we need to take full advantage of the resolution inherent in the data. The development of a high-resolution subsurface conductivity imaging methods would have benefits far beyond the petroleum application. Such techniques would be very useful in environmental applications, mineral and geothermal exploration and for civil engineering applications.

23064 (DOE/BC–95000152) **Electrical and electromagnetic methods for reservoir description and process monitoring. Annual report, October 1, 1992–September 30, 1993.** Morrison, H.F.; Lee, K.H.; Becker, A. Lawrence Berkeley Lab., CA (United States). Jul 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95000152. Source: OSTI; NTIS; GPO Dep.

It is well known that electrical conductivity of rock is closely related to the porosity, hydrologic permeability, saturation, and the type of fluid in it. These rock parameters play important roles in the development and production of hydrocarbon (petroleum and natural gas) resources. For these reasons, resistivity well logs have long been used by geologists and reservoir engineers in petroleum industries to map variations in pore fluid, to distinguish between rock types, and to determine completion intervals in wells. Reservoir simulation and process monitoring rely heavily on the physical characteristics of the reservoir model. At the beginning of FY-91 a coordinated electrical and electromagnetic (EM) geophysical research program for petroleum reservoir characterization and process monitoring was initiated. Parties involved in this program include Lawrence Berkeley Laboratory (LBL), Lawrence Livermore Laboratory (LLNL), Sandia National Laboratory (SNL), and University of California at Berkeley (UCB). The overall objectives of the program were: to integrate research funded by DOE for hydrocarbon recovery into a focused effort to demonstrate the technology in the shortest time with the least cost; to assure industry acceptance of the technology developed by having industry involvement in the planning, implementation, and funding of the research; to focus the research on real world problems that have the potential for solution in the near term with significant energy payoff. Specific research activities conducted have been in the following areas: (1) EM modeling development; (2) data interpretation methods development; (3) hardware and instrumentation development; (4) EOR and reservoir characterization; (5) controlled field experiments. The primary focus of these activities was in the development of reliable inversion and imaging schemes that could yield conductivity distributions from measured electrical and EM field data.

23065 (DOE/BC–95000153) **Electrical and electromagnetic methods for reservoir description and process monitoring. Annual report, October 1, 1991–September 30, 1992.** Morrison, H.F.; Lee, Ki Ha; Becker, A. California Univ., Berkeley, CA (United States). Lawrence Berkeley Lab. Jul 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95000153. Source: OSTI; NTIS; GPO Dep.

During FY-91 a coordinated electrical and electromagnetic (em) geophysical research program for petroleum reservoir characterization and process monitoring was initiated. Parties involved in this program include Lawrence Berkeley Laboratory (LBL), Lawrence Livermore Laboratory (LLNL), Sandia National Laboratory (SNL), and University of California at Berkeley (UCB). The overall objectives of the program are: To integrate research funded by DOE for hydrocarbon recovery into a focused effort to demonstrate the technology in the shortest time with the least cost. To assure industry acceptance of the technology developed by having industry involvement in the planning, implementation, and funding of the research. To focus the research on real world problems that have the potential for solution in the near term with significant energy payoff. Specific research activities conducted through this integrated effort have been in the following five general areas: em modeling development; data interpretation methods development; hardware and instrumentation development; EOR and reservoir characterization; and controlled field experiments. At LBL/UCB research has been focused on activities (1), (2), and (5) in FY92. The primary focus of these activities is in the development of reliable inversion and imaging schemes that can yield conductivity distributions from measured electrical and em field data. The development of accurate forward modeling algorithms and the high-quality scale model experiment are necessarily the early part of the field experiment design and the inversion scheme development for ultimately monitoring the front tracking in existing reservoirs. Technical progress for the following activities are summarized in this report: tim-domain electromagnetic (TEM) scale model; inversion and imaging of em data; and controlled field experiments.

23066 (DOE/ER/14084–4) **Reservoir characterization by cross-hole seismic imaging. Final report, September 15, 1989–June 30, 1994.** Turpening, R.M.; Matarese, J.R.; Toksoez, M.N. Massachusetts Inst. of Tech., Cambridge, MA (United States). Earth Resources Lab. Jul 1995. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14084. Order Number DE95016149. Source: OSTI; NTIS; GPO Dep.

Better characterization of reservoirs requires better images of those reservoirs. This report documents the research undertaken at the Massachusetts Institute of Technology's Earth Resources Laboratory (ERL) to improve seismic tomographic images. In addition, the new imaging method was applied to a data set collected in a producing oil field. The method developed is nonlinear travel time tomography. This technique uses the travel time of the first arriving energy at a receiver and distributes that time back along realistic ray paths. This is an important distinction between this method and previous methods that used either straight ray paths from source to receiver or fixed ray paths (ray paths fixed by an a priori model). The nonlinearity arises during each iteration in the matching of observed travel times with those determined from a model. In this technique the model is updated during each iteration (the velocity structure is changed) and new ray paths are computed in that update model. Thus the resulting image is based on physically realistic ray paths. Tomography resolution is not merely a simple function of the wavelength of the seismic energy used but also involves a measure of how well a given region has been sampled by ray paths. Moreover, the ray paths must represent a wide variation in inclination as they pass through a given spatial cell. This imaging technique was applied to a compressional wave data set collected at ERL's Michigan Test Site located in the Northern Reef Trend of MI. It consists of two deep boreholes that straddle a producing reef. Two hundred source positions and two hundred receiver positions were used to obtain 40,000 ray paths. Although ERL's boreholes are 2,000 ft apart, kilohertz data was obtained. The resulting image of the reservoir showed a low velocity zone inside the reef and a thin layer of low velocity that intersected one of the boreholes. The presence of this thin layer was confirmed by logs and borehole engineering.

23067 (SAND–95-0222C) **Origin, diagnostics, and mitigation of a salt dissolution sinkhole at the US Strategic Petroleum Reserve storage site, Weeks Island, Louisiana.** Neal, J.T. (Sandia National Labs., Albuquerque, NM (United States)); Myers, R.E. Sandia National Labs., Albuquerque, NM (United States). 27 Jan 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951098–1: 5. international symposium on land subsidence, The Hague (Netherlands), 16-20 Oct 1995). Order Number DE95008505. Source: OSTI; NTIS; GPO Dep.

A sinkhole was first observed in May 1992 over the edge of the two-level former salt mine that was converted for oil storage by the US Strategic Petroleum Reserve (SPR). Diagnostic studies that included geophysical, geochemical, drilling, and hydrological methods suggest a direct connection exists between the surface collapse area and the underground mine as shown by correlative measurements of sediment slump rates and brine influx into the mine. The dissolution of salt below the sinkhole that initiated the leak into the mine was likely caused by several confluent geologic

processes, and exacerbated by mining-induced stresses that created fractures which served as hydrologic flowpaths. Modeling studies of mine stresses show that years may be required before tensional cracking begins to occur, but once begun can continue to develop, and relieve the stress in that specific regime. The crack regime creates the avenue for incursion of groundwater, very slowly initially, but gradually enlarging as undersaturated groundwater dissolves salt on the sides of the crack. Mitigation measures include increasing the mine pressurization, slowing the dissolution by injecting brine into the sinkhole throat, and freeze grouting to restrict hydrologic flowpaths.

0203 Drilling and Production

Refer also to citation(s) 23055, 23060, 23061, 23062, 23065, 23101, 23118

23068 (ANL/EA/CP–83975) **Synthetic drilling muds: Environmental gain deserves regulatory recognition.** Burke, C.J.; Veil, J.A. Argonne National Lab., Washington, DC (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950333–3: 2. SPE/EPA exploration and production environmental conference: government and industry working together to find cost effective approaches to protecting the environment, Houston, TX (United States), 27-29 Mar 1995). Order Number DE95012279. Source: OSTI; NTIS; GPO Dep.

Efficient drilling technology is essential to meet the needs of the oil industry. Both the challenges of new oil provinces, especially in offshore waters, and the demands for efficient environmental protection have driven the development of new technology. Drilling mud is a key factor influencing drilling technology use in modern drilling operations. New oil industry developments involve directional and horizontal drilling as well as drilling in frontier areas at greater and greater depths. Such capabilities and conditions demand careful attention to the selection and engineering of efficient mud systems.

23069 (BNL–60119) **Effects of selected thermophilic microorganisms on crude oils at elevated temperatures and pressures. Final report.** Premuzic, E.T.; Lin, M.S. Brookhaven National Lab., Upton, NY (United States). Jul 1995. 174p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95000159. Source: OSTI; NTIS; GPO Dep.

During the past several years, a considerable amount of work has been carried out showing that microbially enhanced oil recovery (MEOR) is promising and the resulting biotechnology may be deliverable. At the Brookhaven National Laboratory (BNL), systematic studies have been conducted which dealt with the effects of thermophilic and thermoadapted bacteria on the chemical and physical properties of selected types of crude oils at elevated temperatures and pressures. Particular attention was paid to heavy crude oils from Venezuela, California, Alabama, Arkansas, Wyoming, Alaska, and other oil producing areas. Current studies indicate that during the biotreatment several chemical and physical properties of crude oils are affected. The oils are (1) emulsified; (2) acidified; (3) there is a qualitative and quantitative change in light and heavy fractions of the crudes; (4) there are chemical changes in fractions containing sulfur compounds; (5) there is an apparent reduction in the concentration of trace metals; (6) the qualitative and quantitative changes appear to be microbial species dependent; and (7) there is a distinction between "biodegraded" and "biotreated" oils. Preliminary results indicate the introduced microorganisms may become the dominant species in the bioconversion of oils. These studies also indicate the biochemical interactions between crude oils and microorganisms follow distinct trends, characterized by a group of chemical markers. Core-flooding experiments have shown significant additional crude oil recoveries are achievable with thermophilic microorganisms at elevated temperatures similar to those found in oil reservoirs. In addition, the biochemical treatment of crude oils has technological applications in downstream processing of crude oils such as in upgrading of low grade oils and the production of hydrocarbon based detergents.

23070 (DOE/BC/14477–18) **An experimental and theoretical study to relate uncommon rock/fluid properties to oil recovery. Final report.** Watson, R. Pennsylvania State Univ., University Park, PA (United States). Jul 1995. 299p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14477. Order Number DE95000164. Source: OSTI; NTIS; GPO Dep.

Waterflooding is the most commonly used secondary oil recovery technique. One of the requirements for understanding waterflood performance is a good knowledge of the basic properties of the reservoir rocks. This study is aimed at correlating rock-pore characteristics to oil recovery from various reservoir rock types and incorporating these properties into empirical models for Predicting oil recovery. For that reason, this report deals with the analyses and interpretation of experimental data collected from core floods and correlated against measurements of absolute permeability, porosity. wettability index, mercury porosimetry properties and irreducible water saturation. The results of the radial-core the radial-core and linear-core flow investigations and the other associated experimental analyses are presented and incorporated into empirical models to improve the predictions of oil recovery resulting from waterflooding, for sandstone and limestone reservoirs. For the radial-core case, the standardized regression model selected, based on a subset of the variables, predicted oil recovery by waterflooding with a standard deviation of 7%. For the linear-core case, separate models are developed using common, uncommon and combination of both types of rock properties. It was observed that residual oil saturation and oil recovery are better predicted with the inclusion of both common and uncommon rock/fluid properties into the predictive models.

23071 (DOE/BC/14862–10) **Productivity and injectivity of horizontal wells. Annual report for the period, March 10, 1994–March 9, 1995.** Fayers, F.J. Stanford Univ., CA (United States). Dept. of Petroleum Engineering. Jul 1995. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93BC14862. Order Number DE95000163. Source: OSTI; NTIS; GPO Dep.

Contents of this annual report include the following: (1) detailed well model for reservoir simulation–task 1; (2) comparative aspects of coning behavior in vertical and horizontal wells–task 1; (3) skin factor calculations for vertical, deviated, and horizontal wells–task 2; (4) a dissipation-based coarse grid system and its application to the scaleup of two phase problems–tasks 2 and 4; (5) analyses of experiments at Marathon Oil Company–task 3; (6) development of mechanistic model for multiphase flow in horizontal wells–task 3; and (7) sensitivity studies of wellbore friction and inflow for a horizontal well–task 8.

23072 (DOE/BC/14864–14) **Study of hydrocarbon miscible solvent slug injection process for improved recovery of heavy oil from Schrader Bluff Pool, Milne Point Unit, Alaska. Annual report, January 1, 1994–December 31, 1994.** Sharma, G.D. Alaska Univ., Fairbanks, AK (United States). Jul 1995. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93BC14864. Order Number DE95000162. Source: OSTI; NTIS; GPO Dep.

Alaska is the second largest oil producing state in the nation and currently contributes nearly 24% of the nations oil production. It is imperative that Alaskan heavy oil fields be brought into production. Schrader Bluff reservoir, located in the Milne Point Unit, which is part of the heavy oil field known as West Sak is estimated to contain 1.5 billion barrels of (14 to 21 degree API) oil-in-place. The field is currently under production by primary depletion. The eventual implementation of enhanced oil recovery (EOR) techniques will be vital for the recovery of additional oil from this reservoir. The availability of hydrocarbon gases (solvents) on the Alaska North Slope make the hydrocarbon miscible solvent injection process an important consideration for the EOR project in Schrader Bluff reservoir. Since Schrader Bluff oil is heavy and viscous, a water-alternating-gas (WAG) type of process for oil recovery is appropriate since such a process tends to derive synergetic benefits from both water injection (which provides mobility control and improvement in sweep efficiency) and miscible gas injection (which provides improved displacement efficiency). A miscible solvent slug

injection process rather than continuous solvent injection is considered appropriate. Slim tube displacement studies, PVT data and asphaltene precipitation studies are needed for Schrader bluff heavy oil to define possible hydrocarbon solvent suitable for miscible solvent slug displacement process. Coreflood experiments are also needed to determine the effect of solvent slug size, WAG ratio and solvent composition on the recovery and solvent breakthrough. A compositional reservoir simulation study will be conducted later to evaluate the complete performance of the hydrocarbon solvent slug process and to assess the feasibility of this process for improving recovery of heavy oil from Schrader Bluff reservoir.

23073 (DOE/BC/14881–12) **Improving reservoir conformance using gelled polymer systems. Annual report, September 15, 1993–September 24, 1994.** Green, D.W.; Willhite, G.P. Kansas Univ., Lawrence, KS (United States). Jul 1995. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92BC14881. Order Number DE95000158. Source: OSTI; NTIS; GPO Dep.

The objectives of the research program are to (1) identify and develop polymer systems which have potential to improve reservoir conformance of fluid displacement processes, (2) determine the performance of these systems in bulk and in porous media, and (3) develop methods to predict their performance in field applications. The research focuses on three types of aqueous gel systems - a polysaccharide (KUSP1) that gels as a function of pH, a polyacrylamide-chromium(III) system and a polyacrylamide-aluminum citrate system. This report describes work conducted during the second year of a three-year program. Progress was made in the utilization of KUSP1 as a gelling agent. It was shown that gels can be formed in situ in porous media using CO_2 or ester hydrolysis to lower pH. An ester was identified that could be used in field-scale operations. It was determined that KUSP1 will form strong gels when ortho boric acid is added to the system. It was also determined, in cooperation with Abbott Laboratories, that KUSP1 can be produced on a commercial scale. Rheological studies showed that shear rate significantly affects gelation time and gel strength. The effect of rock-fluid interactions at alkaline conditions was examined experimentally and through mathematical modeling. A model was developed that treats non-equilibrium conditions and this is an improvement over previously published models.

23074 (DOE/BC/14884–12) **Surfactant loss control in chemical flooding spectroscopic and calorimetric study of adsorption and precipitation on reservoir minerals. Annual report, September 30, 1993–September 30, 1994.** Somasundaran, P. Columbia Univ., New York, NY (United States). Jun 1995. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92BC14884. Order Number DE95000157. Source: OSTI; NTIS; GPO Dep.

The aim of this project is to elucidate the mechanisms underlying adsorption and surface precipitation of flooding surfactants on reservoir minerals. Effect of surfactant structure, surfactant combinations, other inorganic and polymeric species is being studied. A multi-pronged approach consisting of micro and nano spectroscopy, microcalorimetry, electrokinetics, surface tension and wettability is used to achieve the goals. The results of this study should help in controlling surfactant loss in chemical flooding and also in developing optimum structures and conditions for efficient chemical flooding processes. During the second year of this three year contract, adsorption/desorption of single surfactants and select surfactant mixtures on alumina and silica was studied. Surfactants studied include the anionic sodium dodecyl sulfate (SDS), cationic tetradecyl trimethyl ammonium chloride (TTAC), nonionic pentadecylethoxylated nonyl phenol (NP-15) and the nonionic octaethylene glycol n-dodecyl ether ($C_{12}EO_8$) of varying hydrocarbon chain length. The microstructure of the adsorbed layer in terms of micropolarity and aggregation numbers was probed using fluorescence spectroscopy. Changes of microstructure upon dilution (desorption) were also studied. Presence of the nonionic surfactant in the mixed aggregate led to shielding of the charge of the ionic surfactant which in-turn promoted aggregation but reduced electrostatic attraction between the charged surfactant and the mineral surface. Strong consequences of surfactant interactions in solution upon adsorption as well as correlations between monomer concentrations in mixtures and adsorption were revealed.

23075 (DOE/BC/14885–10) **Development of cost-effective surfactant flooding technology. Annual report for the period, September 30, 1993–September 29, 1994.** Pope, G.; Sepehrnoori, K. Texas Univ., Austin, TX (United States). Center for Petroleum and Geosystems Engineering. Aug 1995. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92BC14885. Order Number DE95000180. Source: OSTI; NTIS; GPO Dep.

This research consists of the parallel development of a new chemical flooding simulator and the application of our existing UTCHEM simulation code to model surfactant flooding. The new code is based upon a completely new numerical method that combines for the first time higher-order finite-difference methods, flux limiters, and implicit algorithms. Results indicate that this approach has significant advantages in some problems and will likely enable us to simulate much larger and more realistic chemical floods once it is fully developed. Additional improvements have also been made to the UTCHEM code, and it has been applied to the study of stochastic reservoirs with and without horizontal wells to evaluate methods to reduce the cost and risk of surfactant flooding. During the second year of this contract, we have already made significant progress on both of these tasks and are ahead of schedule on both of them.

23076 (DOE/BC/14892–5) **Visual display of reservoir parameters affecting enhanced oil recovery. FY 1994 annual report.** Wood, J.R. Michigan Technological Univ., Houghton, MI (United States). Jun 1995. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93BC14892. Order Number DE95000148. Source: OSTI; NTIS; GPO Dep.

Evaluation of oil and gas properties for enhanced oil recovery (EOR) involves a high degree of risk, especially when the fields are old and well past their prime. The purpose of this project is to provide the small-to-medium size oil field operator with the tools necessary to do an EOR evaluation of the same quality and sophistication that only large international oil companies have been able to afford to date. This approach utilizes readily available, affordable computer software and analytical services. This project will provide a detailed example, based on a field trial, of how to evaluate a field for EOR operations utilizing data typically available in a field which has undergone primary development. After reviewing PC-based software from most major vendors, the authors decided that the most effective way to provide a user-friendly, state-of-the-art package to the independent producers who are primary clients is to link the best modules from four different systems: a commercial database, a wireline log analysis program, a mapping program, and a 2D and 3D visualization program, into a flexible, user-friendly unit. This would result in a product that could be used by small oil and gas companies to perform computerized reservoir studies. Progress to date is described.

23077 (DOE/BC/14897–7) **Anisotropy and spatial variation of relative permeability and lithologic character of Tensleep Sandstone reservoirs in the Bighorn and Wind River Basins, Wyoming. Second quarterly, second year, technical progress report, January 1, 1995–March 31, 1995.** Dunn, T.L. Wyoming Univ., Laramie, WY (United States). Inst. for Energy Research. 13 Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-93BC14897. Order Number DE95013819. Source: OSTI; NTIS; GPO Dep.

This study is designed to provide improvements in reservoir characterization techniques. Activities include: an examination of the spatial variation and anisotropy of relative permeability in the Tensleep Sandstone reservoirs of Wyoming; the placement of that variation and anisotropy into paleogeographic, depositional and diagenic frameworks; the development of pore system imagery techniques for the calculation of relative permeability; and reservoir simulations testing the impact of permeability and anisotropy on enhanced oil recovery. Results are described.

23078 (DOE/BC/14899–24) **Flow and displacement of Bingham plastics in porous media. Topical report.** Shah, C. (Univ. of Southern California, Los Angeles, CA (United States). Dept. of

Chemical Engineering); Kharabaf, H.; Yortsos, Y. Stanford Univ., CA (United States). Jul 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93BC14899. Order Number DE95000165. Source: OSTI; NTIS; GPO Dep.

Bingham plastics, which exhibit a finite yield stress at zero shear rate, have been used to model the flow behavior of certain heavy oils at reservoir conditions. In such fluids, the onset of flow and displacement occurs only after the applied pressure gradient exceeds a minimum value. Understanding the flow behavior of such fluids has been limited to phenomenological approaches. In this paper, we present numerical simulations and experimental visualization of flow and immiscible displacement of Bingham plastics in porous media using micromodels. First, we describe a novel pore network simulation approach to determine the onset of flow. The dependence of the critical yield stress on the pore-size distribution is discussed. Visualization experiments of the constant-rate immiscible displacement of Bingham plastics in glass micromodels and Hele-Shaw cells are next presented. The process is subsequently simulated in a pore network. Experiments are successfully simulated with the pore network model. We discuss the effect of the yield stress and injection rate on the displacement patterns. We also propose a classification of the displacement patterns, similar to that for Newtonian displacement.

23079 (DOE/BC/14899–25) **Visualization and simulation of immiscible displacement in fractured systems using micromodels: Steam injection.** Yortsos, Y.C. University of Southern California, Los Angeles, CA (United States). Dept. of Chemical Engineering. Jul 1995. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93BC14899. Order Number DE95000150. Source: OSTI; NTIS; GPO Dep.

A study of steam and hot water injection processes in micromodel geometries that mimic a matrix-fracture system was undertaken. The followings were observed: Light components existing in the crude oil generated a very high efficient gas-drive at elevated temperatures. This gas generation in conjunction with natural surfactant existing in the crude oil, lead to the formation of a foam in the fracture and to improved displacement in the matrix. We observed that the steam enters the fracture and the matrix depending on whether the steam rate exceeds or not the critical values. The resulting condensed water also moves preferentially into the matrix or the fracture depending on the corresponding capillary number. Since steam is a non-wetting phase as a vapor, but becomes a wetting phase when condensed in a water-wet system, steam injection involves both drainage and imbibition. It was found that all of the oil trapped by the condensed water can be mobilized and recovered when in contact with steam. We also examined hot-water displacement. In comparison with cold-water experiments at the same capillary number, a higher sweep efficiency for both light and heavy oils was observed. It was found that the loam generated in the fracture during hot-water injection, is more stable than in steamflooding. Nonetheless, hot-water injection resulted into less efficient displacement in its absence.

23080 (DOE/BC/14899–26) **Visualization and simulation of immiscible displacement in fractured systems using micromodels: Imbibition.** Hadghighi, M.; Yortsos, Y.C. University of Southern California, Los Angeles, CA (United States). Dept. of Chemical Engineering. Jul 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93BC14899. Order Number DE95000149. Source: OSTI; NTIS; GPO Dep.

A study of imbibition processes in micromodel geometries that mimic a matrix-fracture system was undertaken. Experiments in glass micromodels and pore network simulation were conducted. It was observed that, at low capillary number values the wetting fluid preferentially invaded the matrix. Two critical capillary numbers were identified, one for the start of penetration in the fracture when the viscosity ratio was much less than one, and another for which the rate of propagation of the front in the fracture is the same with that in the matrix, when the viscosity ratio was greater than one. These critical capillary numbers were well matched with the results of a pore network simulation. We also developed a simplified theory for both critical numbers. Free imbibition in fractured system was investigated an[] compared favorably with pore network simulation. This process first involves the ra.pi(i invasion of the matrix, followed by the subsequent penetration of the fracture.

23081 (DOE/BC/14899–27) **Scaling of bubble growth in a porous medium. Topical report.** Satik, C. (Univ. of Southern California, Los Angeles, CA (United States). Dept. of Chemical Engineering); Yortsos, Y.; Li, X. Stanford Univ., CA (United States). Jul 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93BC14899. Order Number DE95000166. Source: OSTI; NTIS; GPO Dep.

Processes involving liquid-to-gas phase change in porous media are routinely encountered, for example in the recovery of oil, geothermal processes, nuclear waste disposal or enhanced heat transfer. They involve diffusion (and convection) in the pore space, driven by an imposed supersaturation in pressure or temperature. Phase change proceeds by nucleation and phase growth. Depending on pore surface roughness, a number of nucleation centers exist, thus phase growth occurs from a multitude of clusters. Contrary to growth in the bulk or in a Hele-Shaw cell, however, growth patterns in porous media are disordered and not compact. As in immiscible displacements, they reflect the underlying pore microstructure. The competition between multiple clusters is also different from the bulk. For example, cluster growth may be controlled by a combination of diffusion (e.g. Laplace equation in the quasi-static case) with percolation. Novel growth patterns axe expected from this competition. While multiple cluster growth is important, the simpler problem of single-bubble growth is still not well understood. In this section, we focus on the growth of a single bubble, subject to a fixed far-field supersaturation (e.g. by lowering the pressure in a supersaturated solution or by raising the temperature in a. superheated liquid). Our emphasis is on deriving a scaling theory for growth at conditions of quasi-static diffusion, guided by recent experimental observations. Visualization of bubble growth in model porous media was recently conducted using 2-D etched-glass micromodels.

23082 (DOE/BC/14899–28) **Supri heavy oil research program. Annual report, February 8, 1994–February 7, 1995.** Brigham, W. Stanford Univ., CA (United States). Petroleum Research Inst. Jul 1995. 175p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93BC14899. Order Number DE95000167. Source: OSTI; NTIS; GPO Dep.

Research projects on enhanced recovery are reported on in this report. Studies include: flow properties; in-situ combustion; steam with additives; and field support definitions.

23083 (DOE/BC/14957–8) **Improved oil recovery in fluvial dominated deltaic reservoirs of Kansas – near-term. Seventh quarterly report, February 1, 1995–April 1, 1995.** Green, D.W.; Willhite, G.P.; Walton, A.; Schoeling, L.; Reynolds, R.; Michnick, M.; Watney, L. Kansas Univ. Center for Research, Inc., Lawrence, KS (United States). 15 Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14957. Order Number DE95014905. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to address waterflood problems of the type found in Cherokee Group reservoirs in southeastern Kansas and in Morrow sandstone reservoirs in southwestern Kansas. Two demonstration sites operated by different independent oil operators are involved in the project. The Nelson Lease (an existing waterflood) is located in Allen County, Kansas in the N.E. Savonburg Field and is operated by James E. Russell Petroleum, Inc. The Stewart Field (on latter stage of primary production) is located in Finney County, Kansas and is operated by Sharon Resources, Inc. General topics to be addressed will be (1) reservoir management and performance evaluation, (2) waterflood optimization, and (3) the demonstration of recovery processes involving off-the-shelf technologies which can be used to enhance waterflood recovery, increase reserves, and reduce the abandonment rate of these reservoir types. The reservoir management portion of the project will involve performance evaluation and will include such work as (1) reservoir characterization and the development of a reservoir database, (2) identification of operational problems, (3) identification of near wellbore problems, (4) identification of unrecovered mobile oil and estimation of recovery factors, and (5)

identification of the most efficient and economical recovery process. The waterflood optimization portion of the project involves only the Nelson Lease. It will be based on the performance evaluation and will involve (1) design and implementation of a water cleanup system for the waterflood, (2) application of well remedial work such as polymer gel treatments to improve vertical sweep efficiency, and (3) changes in waterflood patterns to increase sweep efficiency. Finally, it is planned to implement an improved recovery process, possibly polymer augmented waterflood: on both field demonstration sites.

23084 (DOE/BC/14960–8) **Post waterflood CO_2 miscible flood in light oil, fluvial-dominated deltaic reservoir. Annual report, October 1, 1993–September 30, 1994.** Bou-Mikael, S. Texaco Exploration and Production, Inc., New Orleans, LA (United States). Jul 1995. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14960. Order Number DE95000173. Source: OSTI; NTIS; GPO Dep.

Texaco Exploration and Production Inc. (TEPI) and the U.S. Department of Energy (DOE) entered into a cost sharing cooperative agreement to conduct an Enhanced Oil Recovery demonstration project at Port Neches. The field is located in Orange County near Beaumont, Texas. The project will demonstrate the effectiveness of the CO_2, miscible process in Fluvial Dominated Deltaic reservoirs. It will also evaluate the use of horizontal CO_2 injection wells to improve the overall sweep efficiency. A data base of FDD reservoirs for the gulf coast region will be developed by LSU, using a screening model developed by Texaco Research Center in Houston. Finally, the results and the information gained from this project will be disseminated throughout the oil industry via a series of SPE papers and industry open forums. Reservoir characterization efforts for the Marginulina sand, are in progress utilizing conventional and advanced technologies including 3-D seismic. Sidewall and conventional. cores were cut and analyzed, lab tests were conducted on reservoir fluids, reservoir BHP pressure and reservoir voidage were monitored as shown. Texaco is utilizing the above data to develop a Stratamodel to best describe and characterize the reservoir and to use it as an input for the compositional simulator. The current compositional model is being revised to integrate the new data from the 3-D seismic and field performance under CO_2 injection, to ultimately develop an accurate economic model. All facilities work has been completed and placed in service including the CO_2 pipeline and metering equipment, CO_2 injection and production equipment, water injection equipment, well work and injection/production lines. The horizontal injection well was drilled and completed on January 15, 1994. CO_2 purchases from Cardox continue at an average rate of 3600 MCFD. The CO_2 is being injected at line pressure of 1350 psi.

23085 (DOE/BC/14960–9) **Post waterflood CO_2 miscible flood in light oil fluvial dominated deltaic reservoirs. Second quarterly technical progress report, [January 1, 1995–March 31, 1995].** Texaco Exploration and Production, Inc., Bridge City, TX (United States). 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14960. Order Number DE95014911. Source: OSTI; NTIS; GPO Dep.

Production from the Marg Area 1 at Port Neches is averaging 392 barrels of oil per day (BOPD) for this quarter. The production drop is due to fluctuation in both GOR and BS&W on various producing well, coupled with low water injectivity in the reservoir. We were unable to inject any tangible amount of water in the reservoir since late January. Both production and injection problems are currently being evaluated to improve reservoir performance. Well Kuhn (No. 6) was stimulated with 120 MMCF of CO_2, and was placed on production in February 1, 1995. The well was shut in for an additional month after producing dry CO_2 initially. The well was opened again in early April and is currently producing about 40 BOPD. CO_2 injection averaged 11.3 MMCFD including 4100 MMCFD purchased from Cardox, while water injection averaged 1000 BWPD with most of the injection occurring in the month of January.

23086 (DOE/BC/14962–7) **The utilization of the microflora indigenous to and present in oil-bearing formations to selectively plug the more porous zones thereby increasing oil recovery during waterflooding. Annual report for the period, January 1, 1994–December 31, 1994.** Brown, L.; Vadie, A. Hughes Eastern Corp., Jackson, MS (United States). Aug 1995. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-94BC14962. Order Number DE95000177. Source: OSTI; NTIS; GPO Dep.

This project is a field demonstration of the ability of insitu indigenous microorganisms in the North Blowhorn Creek Oil Field to reduce the flow of injection water in the more permeable zones thereby diverting flow to other areas of the reservoir and thus increase the efficiency of the waterflooding operation. This effect is to be accomplished by adding inorganic nutrients in the form of Potassium nitrate and orthophosphate, to the injection water. In Phase I, which has been completed, the following results were obtained. Two new wells were drilled in the field and live cores were recovered. Analyses of the cores proved that viable microorganisms were present and since no sulfate-reducing bacteria (SRB) were found, the area in which the wells were drilled, probably had not been impacted by injection water, since SRB were prevalent in fluids from most wells in the field. Laboratory waterflooding tests using live cores demonstrated that the rate of flow Of simulated production water through the core increased with time when used alone while the rate of flow decreased when nitrate and phosphate salts were added to the simulated production water. Since there is only a small amount of pressure on the influent, the simulated production water was not forced to sweep other areas of the core. The field demonstration (Phase II) involves adding nutrients to four injector wells and monitoring the surrounding producers. The exact kind and amounts of nutrients to be employed and the schedule for their injection were formulated on the basis of information obtained in the laboratory waterflooding tests conducted using the live cores from the field. Results obtained in these tests will not only be compared to historical data for the wells but also to four injectors and their corresponding producers (control) which were chosen for their similarity to the four test patterns.

23087 (DOE/BC/14963–8) **West Hackberry Tertiary Project. Quarterly technical progress report, March 3, 1995–June 2, 1995.** Gillham, T.; Cerveny, B.; Turek, E. Amoco Production Co., Houston, TX (United States). 31 May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14963. Order Number DE95014910. Source: OSTI; NTIS; GPO Dep.

The goal of the West Hackberry Tertiary Project is to demonstrate the technical and economic feasibility of combining air injection with the Double Displacement Process for tertiary oil recovery. The Double Displacement Process is the gas displacement of a water invaded oil column for the purpose of recovering oil through gravity drainage. The novel aspect of this project is the use of air as the injection fluid. The target reservoir for the project is the Camerina C-1,2,3 Sand located on the West Flank of West Hackberry Field in Cameron Parish, Louisiana. If successful, this project will demonstrate that the use of air injection in the Double Displacement Process can economically recover oil in reservoirs where tertiary oil recovery is presently uneconomic. Air injection was initiated on November 17, 1994. During this quarter, the West Hackberry Tertiary Project completed the first six months of air injection operations. The following events are reviewed in this quarter's technical progress report: (1) early nitrogen breakthrough seen in the Gulf Land D No. 56; (2) corrosion downhole in the air injectors and at the wellsite injection skid; (3) fill in the Watkins No. 16 air injection well; (4) temperature logs run in air injectors(after 24 hours of shut-in); (5) substantial air compressor down time; and (6) official startup ceremony and technology transfer activities.

23088 (DOE/BC–95000168) **Foam flow through a transparent rough-walled rock fracture.** Kovscek, A. (and others); Tretheway, D.; Radke, C. Lawrence Berkeley Lab., CA (United States). Jul 1995. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95000168. Source: OSTI; NTIS; GPO Dep.

This paper presents an experimental study of nitrogen, water, and aqueous foam flow through a transparent replica of a natural rough-walled rock fracture with a hydraulic aperture of roughly 30 μm. It is established that single-phase flow of both nitrogen and water is well described by analogy to flow between parallel plates. Inertial effects caused by fracture roughness become important in

single-phase flow as the Reynolds number approaches 1. Foam exhibits effective control of gas mobility. Foam flow resistances are approximately 10 to 20 times greater than those of nitrogen over foam qualities spanning from 0.60 to 0.99 indicating effective gas-mobility control. Because previous studies of foam flow have focused mainly upon unfractured porous media, little information is available about foam flow mechanisms in fractured media. The transparency of the fracture allowed flow visualization and demonstrated that foam rheology in fractured media depends upon bubble shape and size. Changes in flow behavior are directly tied to transitions in bubble morphology.

23089 (DOE/BC–95000169) **A population balance model for transient and steady-state foam flow in Boise sandstone.** Kovscek, A.; Patzek, T.; Radke, C. Lawrence Berkeley Lab., CA (United States). Jul 1995. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95000169. Source: OSTI; NTIS; GPO Dep.

An experimental and mechanistic-modeling study is reported for the transient flow of aqueous foam through 1.3-μm^2 (1.3-D) Boise sandstone at backpressures in excess of 5 MPa (700 psi) over a quality range from 0.80 to 0.99. Total superficial velocities range from as little as 0.42 to 2.20 m/day (1.4 ft/day to 7 ft/day). Sequential pressure taps and gamma-ray densitometry measure flow resistance and in-situ liquid saturations, respectively. We garner experimental pressure and saturation profiles in both the transient and steady states. Adoption of a mean-size foam-bubble conservation equation along with the traditional reservoir simulation equations allows mechanistic foam simulation. Since foam mobility depends heavily upon its texture, the bubble population balance is both useful and necessary as the role of foam texture must be incorporated into any model which seeks accurate prediction of flow properties. Our model employs capillary-pressure-dependent kinetic expressions for lamellae generation and coalescence and also a term for trapping of lamellae. Additionally, the effects of surfactant chemical transport are included. We find quantitative agreement between experimental and theoretical saturation and pressure profiles in both the transient and steady states.

23090 (DOE/MC/30127–4061) **Providing solutions to energy and environmental problems. Quarterly technical progress report, October–December 1994.** Western Research Inst., Laramie, WY (United States). Feb 1995. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-93MC30127. Order Number DE95014924. Source: OSTI; NTIS; GPO Dep.

Progress reports are briefly described for the following tasks: Development and demonstration of a practical electric downhole steam generator for thermal recovery of heavy oil and tar; wetting behavior of selected crude oil/brine/rock systems; coal gasification, power generation and product market study; the impact of leachate from clean coal technology waste on the stability of clay liners; injecton into coal seams for simultaneous CO_2 mitigation and enhanced recovery of coalbed methane; optimization of carbonizer operations in the FMC coke process; chemical sensor and field screening technology development; demonstration of the Koppleman "Series C" process using a batch; test unit with powder river basin coal as feed; remote chemical sensor development; market assessment and technical feasibility study of PFBC ash use; solid state NMR analysis of naturally and artificially matured kerogens; contained recovery of oily wastes field demonstration with bell lumber and pole; insitu treatment of manufactured gas plant contaminated soils; development and demonstration of a wood-fired gas turbine system; solid state NMR analysis of Mowry Formation Shale from different sedimentary basins; and acid-mine drainage prevention, control, and treatment development for the stockett/sand coulee area.

23091 (DOE/MC/30127–4062) **Providing solutions to energy and environmental problems. Quarterly technical progress report, January–March 1995.** Western Research Inst., Laramie, WY (United States). May 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-93MC30127. Order Number DE95014922. Source: OSTI; NTIS; GPO Dep.

Brief progress reprots are presented for the following tasks: development and demonstration of a practical electric downhole steam generator for thermal recovery of heavy oil and tar; wetting behavior of selected crude oil/brine/rock systems; coal gasification, power generation and product market study; the impact of leachate from clean coal technology waste on the stability of clay liners; injection into coal seams for simultaneous co_2 mitigation and enhanced recovery of coalbed methane; optimization of carbonizer operations in the FMC coke process; chemical sensor and field screening technology development; demonstration of the Koppleman "Series C" process using a batch; test unit with powder river basin coal as feed; remote chemical sensor development; market assessment and technical feasibility study of PFBC ash use; solid state NMR analysis of naturally and artificially matured kerogens; contained recovery of oily wastes field demonstration with bell lumber and pole; insitu treatment of manufactured gas plant contaminated soils; development and demonstration of a wood-fired. Gas turbine system; solid state NMR analysis of mowry formation shale from different sedimentary basins; and acid-mine drainage prevention, control, and treatment development for the stockett/sand coulee area.

23092 (DOE/MT/92007–9) **Characterization of oil and gas waste disposal practices and assessment of treatment costs. Final report.** Bedient, P. Rice Univ., Houston, TX (United States). Aug 1995. 203p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92MT92007. Order Number DE95000175. Source: OSTI; NTIS; GPO Dep.

This study examines wastes associated with the onshore exploration and production of crude oil and natural gas in the United States. The objective of this study was to update and enhance the current state of knowledge with regard to oil and gas waste quantities, the potential environmental impact of these wastes, potential methods of treatment, and the costs associated with meeting various degrees of treatment. To meet this objective, the study consisted of three tasks: (1) the development of a Production Environmental Database (PED) for the purpose of assessing current oil and gas waste volumes by state and for investigating the potential environmental impacts associated with current waste disposal practices on a local scale; (2) the evaluation of available and developing technologies for treating produced water waste streams and the identification of unit process configurations; and (3) the evaluation of the costs associated with various degrees of treatment achievable by different treatment configurations. An updated assessment of the annual domestic Production volume of drilling waste and produced water by onshore drilling and production activity showed there to be a general decline in the volumes of drilling waste being produced over the period 1985 – 1992 as well as an apparent reduction in the volume of produced water generated since 1986. A 59% reduction in the volume of drilling waste over 1985 levels was estimated. The evaluation of feasible technologies for the treatment of produced water waste streams was handled in the context of comparing the level of treatment achievable withthe associated cost of treatment. Treatment processes were evaluated for the removal of four categories of produced water contaminants: particulate material, volatile organic compounds, adsorbable organic compounds, and dissolved inorganic species. Results showed dissolved inorganic species to be the most costly to remove.

23093 (DOE/MT/92011–12) **Geologic, geochemical, and geographic controls on NORM in produced water from Texas oil, gas, and geothermal reservoirs. Final report.** Fisher, R. Texas Univ., Austin, TX (United States). Aug 1995. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92MT92011. Order Number DE95000178. Source: OSTI; NTIS; GPO Dep.

Water from Texas oil, gas, and geothermal wells contains natural radioactivity that ranges from several hundred to several thousand Picocuries per liter (pCi/L). This natural radioactivity in produced fluids and the scale that forms in producing and processing equipment can lead to increased concerns for worker safety and additional costs for handling and disposing of water and scale. Naturally occurring radioactive materials (NORM) in oil and gas operations are mainly caused by concentrations of radium-226 (^{226}Ra) and radium-228 (^{228}Ra), daughter products of uranium-238 (^{238}U) and thorium-232 (^{232}Th), respectively, in barite scale. We examined (1) the geographic distribution of high NORM levels in oil-producing and gas-processing equipment, (2) geologic controls

on uranium (U), thorium (Th), and radium (Ra) in sedimentary basins and reservoirs, (3) mineralogy of NORM scale, (4) chemical variability and potential to form barite scale in Texas formation waters, (5) Ra activity in Texas formation waters, and (6) geochemical controls on Ra isotopes in formation water and barite scale to explore natural controls on radioactivity. Our approach combined extensive compilations of published data, collection and analyses of new water samples and scale material, and geochemical modeling of scale Precipitation and Ra incorporation in barite.

0204 Processing

Refer also to citation(s) 22989

23094 (DOE/MT/92020–10) **Improvement of hydrogen solubility and entrainment in hydrocracker feedstocks. Quarterly technical report, January 1, 1995–March 31, 1995.** Kabadi, V.N. North Carolina Agricultural and Technical State Univ., Greensboro, NC (United States). Dept. of Chemical Engineering. [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92MT92020. Order Number DE95014904. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to determine the conditions for the hydrogen-heavy oil feed preparation so as to optimize the yield of hydrocracking reactions. Proper contacting of hydrogen with heavy oil on the catalytic bed is necessary to improve the yields of the hydrocracking reactions. It is most desirable to have the necessary amount of hydrogen available either in the dissolved or in entrained state, so that hydrogen diffusion to the reaction site does not provide rate controlling resistance to the overall rates of hydrocracking reactions. This project proposes to measure solubility and entrainment data for hydrogen in heavy oils at conditions such as in hydrocrackers, and investigate the improvement of these properties by usage of appropriate additives. Specifically, measurements will be carried out at temperatures up to 300°C and pressures up to 120 atmospheres. Correlations for solubility and entrainment kinetics will be developed from the measured data, and a method for estimating yield of hydrocracking reactions using these correlations will be suggested. Exxon Research and Engineering Company will serve as private sector collaborator providing A&T with test samples and some technical expertise that will assure successful completion of the project. Results are presented for solubility of hydrogen in hydrocarbons and in heavy petroleum fractions. Comparison with experimental data shows good agreements. It is also demonstrated that the model is easily applied to compute solubility of hydrogen in heavy petroleum fractions with fair degree of accuracy. Detailed results are presented.

0205 Products and By-Products

Refer also to citation(s) 23002

23095 (LA-UR–95-741) **A three-phase centrifuge to minimize waste from production tank bottoms and sludges: An economic analysis.** Polston, C.E. (Los Alamos National Lab., NM (United States)); Parkinson, W.J.; Graham, A.L.; Steele, R.D.; Bretz, R.E. Los Alamos National Lab., NM (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States);Rio Grande Technology Foundation (United States). DOE Contract W-7405-ENG-36. (CONF-950333–1: 2. SPE/EPA exploration and production environmental conference: government and industry working together to find cost effective approaches to protecting the environment, Houston, TX (United States), 27-29 Mar 1995). Order Number DE95007831. Source: OSTI; NTIS; GPO Dep.

The performance of a three-phase centrifuge process in separating tank bottoms into salable oil, brine and solids was scaled using the sigma method. The profitability was analyzed for a range of processed volumes for three business scenarios: producer owned, service company and a disposal facility. Centrifuge processes operated at full capacity in these situations may be very profitable investments but any investment decision should be heavily influenced by the annual volume to be processed, the quality of the feed and the price received for separated oil.

0206 Health and Safety

Refer also to citation(s) 23107

23096 (BNL–61987) **Risk assessment for produced water discharges to Louisiana Open Bays.** Meinhold, A.F.; DePhillips, M.P.; Holtzman, S. Brookhaven National Lab., Upton, NY (United States). 23 Jun 1995. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95015403. Source: OSTI; NTIS; GPO Dep.

Data were collected prior to termination of discharge at three sites (including two open bay sites at Delacroix Island and Bay De Chene) for the risk assessments. The Delacroix Island Oil and Gas Field has been in production since the first well drilling in 1940; the Bay De Chene Field, since 1942. Concentrations of 226Ra, 228Ra, 210Po, and 228Th were measured in discharges. Radium conc. were measured in fish and shellfish tissues. Sediment PAH and metal conc. were also available. Benthos sampling was conducted. A survey of fishermen was conducted. The tiered risk assessment showed that human health risks from radium in produced water appear to be small; ecological risk from radium and other radionuclides in produced water also appear small. Many of the chemical contaminants discharged to open Louisiana bays appear to present little human health or ecological risk. A conservative screening analysis suggested potential risks to human health from Hg and Pb and a potential risk to ecological receptors from total effluent, Sb, Cd, Cu, Pb, Ni, Ag, Zn, and phenol in the water column and PAHs in sediment; quantitiative risk assessments are being done for these contaminants.

0207 Economic, Industrial, and Business Aspects

23097 (DOE/EIA–0109(95/06)) **Petroleum supply monthly, June 1995 with data for April 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 28 Jun 1995. 150p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014526. Source: OSTI; NTIS; GPO; GPO Dep.

The Petroleum Supply Monthly (PSM) is one of a family of four publications produced by the Petroleum Supply Division within the Energy Information Administration (EIA) reflecting different levels of data timeliness and completeness. The other publications are the Weekly Petroleum Status Report (WPSR), the Winter Fuels Report, and the Petroleum Supply Annual (PSA). Data presented in the PSM describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in primary supply. Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States. Data presented in the PSM are divided into two sections: Summary Statistics and Detailed Statistics.

23098 (DOE/EIA–0380(95/07)) **Petroleum marketing monthly with data for April 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 5 Jul 1995. 199p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014949. Source: OSTI; NTIS; GPO; GPO Dep.

The Petroleum Marketing Monthly (PMM) provides information and statistical data on a variety of crude oils and refined petroleum products. The publication presents statistics on crude oil costs and refined petroleum products sales for use by industry, government private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Refined petroleum product sales data include motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane. The Petroleum Marketing Division, Office

of Oil and Gas, Energy Information Administration ensures the accuracy, quality, and confidentiality of the published data on the Petroleum Marketing Monthly. Monthly statistics on purchases of crude oil and sales of petroleum products are presented in the Petroleum Marketing Monthly in five sections: Summary statistics; crude oil prices; prices of petroleum products; volumes of petroleum products; and prime supplier sales volumes of petroleum products for local consumption.

23099 (DOE/EIA–0520(95/06)) **International petroleum statistics report, June 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 27 Jun 1995. 83p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014555. Source: OSTI; NTIS; GPO; GPO Dep.

The report presents data on international oil production, demand, imports, exports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil demand and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1985, and monthly data for the most recent two years. Section 2 presents an oil supply/demand balance for the world. This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, demand, and trade in OECD countries. World oil production and OECD demand data are for the years 1970 through 1994; OECD stocks from 1973 through 1994; and OECD trade from 1984 through 1994. 4 figs., 45 tabs.

23100 (DOE/EIA–0543(95/1Q)) **US energy industry financial developments, First quarter 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 19 Jun 1995. 22p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014360. Source: OSTI; NTIS; GPO; GPO Dep.

This report traces key developments in US energy companies' financial performance for the first quarter of 1995. Financial data (only available for publicly-traded US companies) are included in two broad groups – fossil fuel production and rate-regulated utilities. All financial data are taken from public sources such as corporate reports and press releases, energy trade publications, and The Wall Street Journal's Earnings Digest. Return on equity is calculated from data available from Standard and Poor's Compustat data service. Since several major petroleum companies disclose their income by lines of business and geographic area, these data are also presented in this report. Although the disaggregated income concept varies by company and is not strictly comparable to corporate income, relative movements in income by lines of business and geographic area are summarized as useful indicators of short-term changes in the underlying profitability of these operations.

0208 Waste Management

Refer also to citation(s) 23092

23101 (DOE/MT/92008–10) **Oil production enhancement through a standardized brine treatment. Final report.** Adewumi, A.; Watson, R.; Tian, S.; Safargar, S.; Heckman, S.; Drielinger, I. Pennsylvania State Univ., University Park, PA (United States). Aug 1995. 256p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92MT92008. Order Number DE95000179. Source: OSTI; NTIS; GPO Dep.

In order to permit the environmentally safe discharge of brines produced from oil wells in Pennsylvania to the surface waters of the Commonwealth and to rapidly brings as many wells as possible into compliance with the law, the Pennsylvania Oil and Gas Association (POGAM) approached the Pennsylvania State University to develop a program designed to demonstrate that a treatment process to meet acceptable discharge conditions and effluent limitations can be standardized for all potential stripper wells brine discharge. After the initial studies, the first phase of this project was initiated. A bench-scale prototype model was developed for conducting experiments in laboratory conditions. The experiments pursued in the laboratory conditions were focused on the removal of ferrous iron from synthetically made brine. Iron was selected as the primary heavy metals for studying the efficiency of the treatment process. The results of a number of experiments in the lab were indicative of the capability of the proposed brine treatment process in the removal of iron. Concurrent with the laboratory experiments, a comprehensive and extensive kinetic study was initiated. This study was necessary to provide the required data base for process modeling. This study included the investigation of the critical pH as well as the rate and order of reactions of the studied elements: aluminum, lead, zinc, and copper. In the second phase of this project, a field-based prototype was developed to evaluate and demonstrate the treatment process effectiveness. These experiments were conducted under various conditions and included the testing on five brines from different locations with various dissolved constituents. The outcome of this research has been a software package, currently based on iron's reactivity, to be used for design purposes. The developed computer program was refined as far as possible using the results from laboratory and field experiments.

23102 (DOE/MT/92010–8) **Wetland treatment of oil and gas well wastewaters. Quarterly technical report, May 25, 1993-August 24, 1993.** Michigan Univ., Ann Arbor, MI (United States). Dept. of Chemical Engineering. 4 Oct 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92MT92010. Order Number DE95012550. Source: OSTI; NTIS; GPO Dep.

In the third quarterly report adsorption of heavy metals ions such as Cu(II) and Cr(VI) onto soils drawn from the laboratory-type wetland was shown to be weak. Secondly, it was shown that modified-clays did adsorb Cr(VI) ions strongly at pH 4.5. Further, studies on the pH dependence of the adsorption of β-naphthoic acid, (NA), a well-documented contaminant in many oil and gas well waste waters onto modified-clays were undertaken and it was shown that uptake of NA by modified-clays was of the high affinity type at pH 4.5 and 7.0, but weak at pH 9.0. Adsorption of heavy metal ions, Cu^{2+}, and Cr(VI) onto algae, a proposed wetland amendment, was carried out and the results were presented and discussed in the fourth quarterly report. Uptake of NA by the soil component of the laboratory-type wetland was monitored as a function of pH. This quarterly report presents results from studies on the uptake of phenol and β-naphthoic acid by laboratory-type wetlands designed and built during the earlier phases of this study. The uptake of phenol by the wetlands is quite rapid, and nearly complete in 50 hours, but it was also found that evaporative losses of phenol from the supernatant water during the same time period was considerable. On the other hand, β-naphthoic acid (NA) is sorbed quite slowly and there was no indication of evaporative losses in the case on NA.

23103 (DOE/MT/92010–10) **Wetland treatment of oil and gas well waste waters. Final report.** Kadlec, R.; Srinivasan, K. Michigan Univ., Ann Arbor, MI (United States). Aug 1995. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92MT92010. Order Number DE95000176. Source: OSTI; NTIS; GPO Dep.

Constructed wetlands are small on-site systems that possess three of the most desirable components of an industrial waste water treatment scheme: low cost, low maintenance and upset resistance. The main objective of the present study is to extend the knowledge base of wetland treatment systems to include processes and substances of particular importance to small, on-site systems receiving oil and gas well wastewaters. A list of the most relevant and comprehensive publications on the design of wetlands for water quality improvement was compiled and critically reviewed. Based on our literature search and conversations with researchers in the private sector, toxic organics such as Phenolics and b-naphthoic acid, (NA), and metals such as CU(II) and CR(VI) were selected as target adsorbates. A total of 90 lysimeters equivalent to a laboratory-scale wetland were designed and built to monitor the uptake and transformation of toxic organics and the immobilization of metal ions. Studies on the uptake of toxic organics such as phenol and b-naphthoic acid (NA) and heavy metals such as Cu(II)

and Cr(VI), the latter two singly or as non-stoichiometric mixtures by laboratory-type wetlands (LWs) were conducted. These LWs were designed and built during the first year of this study. A road map and guidelines for a field-scale implementation of a wetland system for the treatment of oil and gas wastewaters have been suggested. Two types of wetlands, surface flow (SF) and sub surface flow (SSF), have been considered, and the relative merits of each configuration have been reviewed.

0209 Environmental Aspects

23104 (DOE/MT/92009–12) **Evaluation of the freeze-thaw/ evaporation process for the treatment of produced waters. Quarterly technical progress report, January 1, 1995–March 31, 1995.** Boysen, J.; Morotti, J. Resource Technology Corp., Laramie, WY (United States). Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92MT92009. Order Number DE95014953. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are related to the development of a commercially-economic natural freeze-thaw/evaporation process for the treatment and purification of water produced in conjunction with oil and gas. Progress is reported on laboratory scale process evaluation and field demonstration of the process.

23105 (ENEA-RT-AMB–92-26) **Identification of oil spill's sources.** Boniforti, R. (ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute). ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute. Oct 1992. 17p. (In Italian). (CONF-9205438–1: Italian-French conference Colombo 1992, Genova (Italy), 22 May 1992). Order Number DE95789727. Source: OSTI; NTIS (US Sales Only); INIS.

Identifying the source of a marine oil spill is complicated because of the rapid modifications (weathering) undergone by oil as soon as it reaches the sea. Deciding if differences occurring between an oil sample collected after the spill and the original oil can be attributed to weathering involves not only adoption of sophisticated analytical methods but also correct sampling techniques and strict adherence to a chain-of-custody procedure. The method described in this paper, largely based on those adopted by some northern European countries, establishes the identity or non-identity of two samples by exploiting differences rather than similarities between them. It increases the efficiency of the method because it is sufficient to establish that there exists only one difference for deciding that two samples are different.

23106 (ETDE-DE–178) **Climate-compatible energy supply in Baden-Wuerttemberg - petroleum products/ refineries.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 14. Hedden, K. (Karlsruhe Univ. (T.H.) (Germany). Engler-Bunte-Institut Bereich 1 - Gas, Erdoel und Kohle); Jess, A.; Fischer, M. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 47p. (In German). Order Number DE95795825. Source: OSTI; NTIS (US Sales Only).

In the framework of the project study "Climate-compatible energy supply in Baden-Wuerttemberg", the Academy of Technology Assessment of Baden-Wuerttemberg currently investigates possibilities of reducing CO_2 emission. As is well known, Germany intends a 25% reduction of CO_2 emissions from 1990 to 2000. This study investigates the field of petroleum products and refineries. (orig./ HS)

23107 (PNL–10454) **Measurement of polynuclear aromatic hydrocarbon concentrations in the plume of Kuwait oil well fires.** Olsen, K.B. (Pacific Northwest Lab., Richland, WA (United States)); Wright, C.W.; Veverka, C.; Ball, J.C.; Stevens, R. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95008897. Source: OSTI; NTIS; INIS; GPO Dep.

Following their retreat from Kuwait during February and March of 1991, the Iraqi Army set fire to over 500 oil wells dispersed throughout the Kuwait oil fields. During the period of sampling from July to August 1991, it was estimated that between 3.29 x 10^6 barrels per day of crude oil were combusted. The resulting fires produced several plumes of black and white smoke that coalesced to form a composite "super" plume. Because these fires were uncontrolled, significant quantities of organic materials were dispersed into the atmosphere and drifted throughout the Middle East. The organic particulants associated with the plume of the oil well fires had a potential to be rich in polynuclear aromatic hydrocarbon (PAH) compounds. Based on the extreme mutagenic and carcinogenic activities of PAHs found in laboratory testing, a serious health threat to the population of that region potentially existed. Furthermore, the Kuwait oil fire plumes represented a unique opportunity to study the atmospheric chemistry associated with PAHs in the plume. If samples were collected near the plume source and from the plume many kilometers downwind from the source, comparisons could be made to better understand atmospheric reactions associated with particle-bound and gas-phase PAHs. To help answer health-related concerns and to better understand the fate and transport of PAHs in an atmospheric environment, a sampling and analysis program was developed.

0250 Combustion

Refer also to citation(s) 23027

03 NATURAL GAS

23108 (DOE/METC/C–95/7191) **Natural Gas Supply SBIR Program.** Shoemaker, H.D.; Gwilliam, W.J. USDOE Morgantown Energy Technology Center, WV (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). (CONF-950494–28: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95014934. Source: OSTI; NTIS; GPO Dep.

The Small Business Innovation Research (SBIR) program was created in 1982 by Public Law 97-219 and reauthorized in 1992 until the year 2000 by Public Law 102-564. The purposes of the new law are to (1) expand and improve the SBIR program, 2) emphasize the program's goal of increasing private sector commercialization of technology developed through Federal R&D, (3) increase small business participation in Federal R&D, and (4) improve the Federal Government's dissemination of information concerning the SBIR program. DOE's SBIR pro-ram has two features that are unique. In the 1995 DOE SBIR solicitation, the DOE Fossil Energy topics were: environmental technology for natural gas, oil, and coal; advanced recovery of oil; natural gas supply; natural gas utilization; advanced coal-based power systems; and advanced fossil fuels research. The subtopics for this solicitation's Natural Gas Supply topic are (1) drilling, completion, and stimulation; (2) low-permeability Formations; (3) delivery and storage; and (4) natural gas upgrading.

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 23050, 23051, 23052, 23053, 23113

23109 (ANL/ES/CP–85486) **Compressional wave character in gassy, near-surface sediments in southern Louisiana determined from variable frequency cross-well, borehole logging, and surface seismic measurements.** Thompson, M.D. (Argonne National Lab., IL (United States)); McGinnis, L.D.; Wilkey, P.L.; Fasnacht, T. Argonne National Lab., IL (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States);Gas Research Inst., Chicago, IL (United States). DOE Contract W-31109-ENG-38. Contract 5088-252-1770. (CONF-950450–11: 8. annual symposium on the application of geophysics to environmental and engineering problems, Orlando, FL (United States), 23-27 Apr 1995). Order Number DE95013493. Source: OSTI; NTIS; GPO Dep.

Velocity and attenuation data were used to test theoretical equations describing the frequency dependence of compressional wave velocity and attenuation through gas-rich sediments in coastal Louisiana. The cross-well data were augmented with velocities

derived from a nearby seismic refraction station using a low-frequency source. Energy at 1 and 3 kHz was successfully transmitted over distances from 3.69 to 30 m; the 5 and 7-kHz data were obtained only at distances up to 20 m. Velocity tomograms were constructed for one borehole pair and covered a depth interval of 10–50 m. Results from the tomographic modeling indicate that gas-induced low velocities are present to depths of greater than 40 m. Analysis of the velocity dispersion suggests that gas-bubble resonance must be greater than 7 kHz, which is above the range of frequencies used in the experiment. Washout of the boreholes at depths above 15 m resulted in a degassed zone containing velocities higher than those indicated in both nearby refraction and reflection surveys. Velocity and attenuation information were obtained for a low-velocity zone centered at a depth of approximately 18 m. Measured attenuations of 1.57, 2.95, and 3.24 dB/m for the 3-, 5-, and 7-kHz signals, respectively, were modeled along with the velocity data using a silt-clay sediment type. Density and porosity data for the model were obtained from the geophysical logs; the bulk and shear moduli were estimated from published relationships. Modeling results indicate that gas bubbles measuring 1 mm in diameter occupy at least 25% to 35% of the pore space.

23110 (DOE/MC/31224–4052) **Naturally fractured tight gas reservoir detection optimization. Quarterly report, July–September 1994.** Coleman Research Corp., Golden, CO (United States). Nov 1994. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-94MC31224. Order Number DE95000096. Source: OSTI; NTIS; GPO Dep.

This report details the field work undertaken by Coleman Energy and Environmental Systems–Blackhawk Geosciences Division (CEES-BGD) and Lynn, Inc. during the summer of 1994 at a gas field in the Wind River Basin in central Wyoming. The field work described herein consisted of two parts: multicomponent feasibility studies during the 3D P-wave survey on the site, and 9C VSP in a well at the site. The objectives of both surveys were to characterize the nature of anisotropy in the reservoir. With the 9C VSP, established practices were used to achieve this objective in the immediate vicinity of the well. With the multicomponent studies, tests were conducted to establish the feasibility of surface recording of the anisotropic reservoir rocks.

23111 (DOE/MC–85000-95/C0477) **Geotechnology for low-permeability gas reservoirs, 1995.** Brown, S. (Sandia National Labs., Albuquerque, NM (United States). Geomechanics Dept.); Harstad, H.; Lorenz, J.; Warpinski, N.; Boneau, T.; Holcomb, D.; Teufel, L.; Young, C. Sandia National Labs., Albuquerque, NM (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). (CONF-950494–22: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012983. Source: OSTI; NTIS; GPO Dep.

The permeability, and thus the economics, of tight reservoirs are largely dependent on natural fractures, and on the in situ stresses that both originated fractures and control subsequent fracture permeability. Natural fracture permeability ultimately determines the gas (or oil) producibility from the rock matrix. Therefore, it is desirable to be able to predict, both prior to drilling and during reservoir production, (1) the natural fracture characteristics, (2) the mechanical and transport properties of fractures and the surrounding rock matrix, and (3) the present in situ stress magnitudes and orientations. The combination of activities described in this report extends the earlier work to other Rocky Mountain gas reservoirs. Additionally, it extends the fracture characterizations to attempts of crosswell geophysical fracture detection using shear wave birefringence and to obtaining detailed quantitative models of natural fracture systems for use in improved numerical reservoir simulations. Finally, the project continues collaborative efforts to evaluate and advance cost-effective methods for in situ stress measurements on core.

0303 Drilling, Production, and Processing

Refer also to citation(s) 23090, 23091, 23092, 23093, 23434

23112 (CONF-950572–) **Intergas '95: International unconventional gas symposium. Proceedings.** Alabama Univ., University, AL (United States); Gas Research Inst., Chicago, IL (United States); Environmental Protection Agency, Washington, DC (United States); Mine Safety and Health Administration, Arlington, VA (United States); Alabama Geological Survey, University, AL (United States); USDOE, Washington, DC (United States). [1995]. 576p. Sponsored by USDOE, Washington, DC (United States);Gas Research Inst., Chicago, IL (United States);Environmental Protection Agency, Washington, DC (United States);Department of Labor, Washington, DC (United States);Alabama Univ., Huntsville, AL (United St From Intergas '95: international unconventional gas symposium; Tuscaloosa, AL (United States); 15-19 May 1995. Order Number DE95014457. Source: OSTI; NTIS; GPO Dep.

The International Unconventional Gas Symposium was held on May 14–20, 1995 in Tuscaloosa, Alabama where 52 reports were presented. These reports are grouped in this proceedings under: geology and resources; mine degasification and safety; international developments; reservoir characterization/coal science; and environmental/legal and regulatory. Each report has been processed separately for inclusion in the Energy Science and Technology Database.

23113 (DOE/MC–25031-95/C0453) **Secondary natural gas recovery – infield reserve growth joint venture: Applications in midcontinent sandstones.** Finley, R.J.; Hardage, B.A. Texas Univ., Austin, TX (United States). Bureau of Economic Geology. [1995]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-88MC25031. (CONF-950494–15: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012314. Source: OSTI; NTIS; GPO Dep.

The primary objective of the Infield Reserve Growth/Secondary Natural Gas Recovery (SGR) project is to develop, test, and verify technologies and methodologies with near- to midterm potential for maximizing the recovery of natural gas from conventional reservoirs in known fields. Additional technical and technology transfer objectives of the SGR project include: To establish how depositional and diagenetic heterogeneities in reservoirs of conventional permeability cause reservoir compartmentalization and, hence, incomplete recovery of natural gas. To document examples of reserve growth occurrence and potential from deltaic and valley-fill sandstones of the Midcontinent as a natural laboratory for developing concepts and testing applications to find secondary gas; to demonstrate how the integration of geology, reservoir engineering, geophysics, and well log analysis/petrophysics leads to strategic recompletion and well placement opportunities for reserve growth in mature fields; and to transfer project results to a wide array of natural gas producers, not just as field case studies, but as conceptual models of how heterogeneities determine natural gas flow units and how to recognize the geologic and engineering clues that operators can use in a cost-effective manner to identify incremental, or secondary, gas.

23114 (DOE/MC/26025–95/C0475) **Liquid-free CO_2/sand fracturing in low-permeability reservoirs.** Mazza, R.L.; Gehr, J.B. Petroleum Consulting Services, Canton, OH (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-90MC26025. (CONF-950494–19: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012981. Source: OSTI; NTIS; GPO Dep.

After 16 months of production, CO_2/sand fractured wells in the Pike County, Kentucky, study area produce 2.0 times more gas than nitrogen gas treated wells and produce 21.9 MMcf additional gas per well. After 16 months of production, CO_2/sand fractured wells in the Pike County, Kentucky, study area produce 4.4 times more gas than nitrogen foam treated wells and produce 33.1 MMcf additional gas per well. For the Pike County, Kentucky, study area, payout times for the incremental cost of stimulation is estimated conservatively at less than 9 months. Both groups of wells in the Pike County, Kentucky, study area show consistent relative Production improvements compared to the overall study area results.

23115 (DOE/MC/26026–95/C0482) **Multistrata exploration and production study.** Brunk, R.G.; Maestas, J.R.; Parsons, P.

West Virginia Coll., Beckley, WV (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-89MC26026. (CONF-950494–27: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95014576. Source: OSTI; NTIS; GPO Dep.

The objective of this project was to develop and verify a geotechnical/geostatistical approach to find natural gas resources and to verify the process by drilling, completing, testing, and producing wells located by the process.

23116 (DOE/MC/28133–95/C0485) **Membrane process for separating H_2S from natural gas.** Baker, R.W. Membrane Technology and Research, Inc., Menlo Park, CA (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC28133. (CONF-950494–24: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95014481. Source: OSTI; NTIS; GPO Dep.

Objective was to develop a membrane process for separating hydrogen sulfide and other impurities (CO_2, water vapor) from low-quality natural gas. A membrane material was identified with very high H_2/CH_4 selectivity in the range of 40–60; membrane production was scaled up to commercial size rolls; high-pressure membrane and module development and optimization were completed; and a membrane permeation flux of $4 \times 10_{-6}$ $cm^3/s\text{-}cm^2cmHg$, twice as high state-of-the-art cellulose acetate membranes, was achieved.

23117 (DOE/MC/28182–95/C0489) **Steerable percussion air drilling system.** Bui, H.D.; Gray, M.A.; Oliver, M.S. Smith International, Inc., Houston, TX (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC28182. (CONF-950494–32: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95015006. Source: OSTI; NTIS; GPO Dep.

In the Steerable Percussion Air Drilling System (SPADS), air percussion is used to drill directionally in hard formations. Compared to mud or air powered PDM motors, SPADS offers directional drilling at high penetration rate, reduced mud costs, negligible formation damage, and immediate indication of hole productivity. Field tests turned up problems ranging from tool design to operation procedures; remedies were developed. There is an optimum WOB (weight on bit) at which torque is reasonably low. The hammer was tested at three different line pressures (200, 300, 350 psig) at optimum WOB in granite, limestone, and sandstone.

23118 (DOE/MC/29077–95/C0490) **Fracturing Fluid Characterization Facility (FFCF): Recent advances.** Shah, S.N.; Fagan, J.E. Oklahoma Univ., Norman, OK (United States). School of Petroleum and Geological Engineering. [1995]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC29077. (CONF-950494–26: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95014985. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are: (1)Investigate fluid rheological behavior, dynamic fluid leak-off behavior, and proppant transport characteristics of various fracturing fluids used for stimulating oil and gas bearing formations. (2) Develop new information for characterizing the behavior of fracturing fluids under conditions more representative of the behavior in actual fractures. (3) Continue utilizing the advanced capabilities of the high pressure simulator (HPS) to perform near-term research and development activities and not to construct a large-scale simulator that was proposed originally. This paper describes equipment enhancements, data acquisition and instrumentation upgrades, R&D test results, and future research planned for the Fracturing Fluid Characterization Facility.

23119 (DOE/MC/31162–95/C0465) **Microbially-enhanced redox solution reoxidation for sweetening sour natural gas.** Rai, C. Texas A and M Univ., Kingsville, TX (United States). Dept. of Chemical and Natural Gas Engineering. [1995]. 14p. Sponsored by USDOE, Washington, DC (United States);Gas Research Inst., Chicago, IL (United States). DOE Contract FG21-94MC31162. 5094-220-3037; Gas Rsearch Institute. (CONF-950494–11: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95012311. Source: OSTI; NTIS; GPO Dep.

About twenty five percent of natural gas produced in the United States is sour containing significant volumes of hydrogen sulfide and other contaminants. Liquid redox processes remove hydrogen sulfide from natural gas. Aqueous solution of chelated ferric ions oxidize the hydrogen sulfide to elemental sulfur. The reduced iron chelate is then oxidized by contact with air and recycled. This requires expensive equipment for regeneration, costly chemicals and the process is usually energy intensive. Recent studies show that the ferric ion regeneration rates are substantially enhanced in presence of acidophilic bacteria. The specific objectives of this project are to advance the technology and improve the economics of the commercial iron-based chelate processes utilizing biologically-enhanced reoxidation of the redox solutions used in these processes, such as LO-CAT II and SulFerox.

0304 Products and By-Products

Refer also to citation(s) 23432, 23433, 23435, 23436, 23437, 23438, 23439, 23440, 23441, 23442, 23443, 23444, 23445

23120 (ETDE/JP-mf–95790784) **Report of liquid fuel conversion technology development. Feasibility survey on liquid fuel conversion.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 123p. (In Japanese). Order Number DE95790784. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

As for methanol as a petroleum substitution fuel, a study is carried out on conditions, etc. suitable for the production plant, with the purpose of practical application of a new method for production of methanol using natural gas as a material. The result indicates that the future methanol plant is expected to produce 5000-10000 tons/day and therefore needs natural gas of 3.7-7.5 million m^3/day and its proved reserves of more than 45-90 billion m^3. It is pointed out that concerning composition of natural gas, the acceptable concentration of carbon dioxide will possibly be lower than that in the steam reforming method. Also reported are that concerning locational conditions, it is difficult to bear a large amount of plant/equipment investment, that the transportation cost is considerably lower than that of LNG, and the marine transportation distance does not become restrictive conditions, and that there are no special conditions of restrictions on the plant and shipping base which are brought by methanol. It is concluded that the Asia and Pacific regions are unsuitable for LNG production, but have a lot of gas fields suitable for methanol production. 15 refs., 5 figs., 60 tabs.

0305 Health and Safety

Refer also to citation(s) 23096

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 23100

23121 (CONF-9410335–, pp. 222-229) **Development of feed-forward neural network models for gas short-term load forecasting.** Brown, R.H. (Marquette Univ., Milwaukee, WI (United States)); Matin, I.; Feng, X. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

The development of feed-forward artificial neural network based models to predict gas consumption on a daily basis is the subject of this paper. The discussion concerns an iterative process based on network sensitivities and intuition regarding selection of proper

input factors. The method is applied in forecasting gas consumption for two regions in the State of Wisconsin, namely, a portion of metropolitan Milwaukee and a region near Fond du Lac. The investigation includes a study of the effects of various network sizes and training algorithms given a limited availability of relevant historical data. The effects of using multiple sources of weather data are also investigated for regions without a centrally located weather recording station. The training results indicate that feed-forward artificial neural network based models reduce the residual predicted consumption root mean squared errors by more than half when compared to models based on linear regression using identical input factors. The inclusion of weather data from multiple sources leads to further error reduction. The models were then used for load forecasting starting in Summer 1994. The static models performed well from the Summer 1993 until the severe cold weather of mid-January 1994. This poor performance was scrutinized; investigations point to probable causes that include severe weather patterns non-existent in the training data and the excitation of consumer behavioral modes either not evident in the training data or not well represented by time-of-the-year input factor proxies. The search for a solution lead to dynamic models that were implemented by updating the neural networks with new data as it became available. These models performed significantly better but still poorly during and after the severe weather of January 1994.

23122 (DOE/MC/13223–95/C0484) **Conversion economics for Alaska North Slope natural gas.** Thomas, C.P.; Robertson, E.P. Lockheed Idaho Technologies Co., Idaho Falls, ID (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-94ID13223. (CONF-950494–29: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95015007. Source: OSTI; NTIS; GPO Dep.

For the Prudhoe Bay field, this preliminary analysis provides an indication that major gas sales using a gas pipeline/LNG plant scenario, such as Trans Alaska Gas System, or a gas-to-liquids process with the cost parameters assumed, are essentially equivalent and would be viable and profitable to industry and beneficial to the state of Alaska and the federal government. The cases are compared for the Reference oil price case. The reserves would be 12.7 BBO for the base case without major gas sales, 12.3 BBO and 20 Tcf gas for the major gas sales case, and 14.3 BBO for the gas-to-liquids conversion cases. Use of different parameters will significantly alter these results; e.g., the low oil price case would result in the base case for Prudhoe Bay field becoming uneconomic in 2002 with the operating costs and investments as currently estimated.

23123 (DOE/MC/27346–95/C0480) **Economics of natural gas upgrading.** Hackworth, J.H.; Koch, R.W. K and M Engineering and Consulting Corp., Washington, DC (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-90MC27346. (CONF-950494–25: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95014024. Source: OSTI; NTIS; INIS; GPO Dep.

Natural gas could be an important alternative energy source in meeting some of the market demand presently met by liquid products from crude oil. This study was initiated to analyze three energy markets to determine if greater use could be made of natural gas or natural gas derived products and if those products could be provided on an economically competitive basis. The three markets targeted for possible increases in gas use were motor fuels, power generation, and the chemical feedstocks market. The economics of processes to convert natural gas to transportation fuels, chemical products, and power were analyzed. The economic analysis was accomplished by drawing on a variety of detailed economic studies, updating them and bringing the results to a common basis. The processes analyzed included production of methanol, MTBE, higher alcohols, gasoline, CNG, and LNG for the transportation market. Production and use of methanol and ammonia in the chemical feedstock market and use of natural gas for power generation were also assessed. Use of both high and low quality gas as a process feed stream was evaluated. The analysis also explored the impact of various gas price growth rates and process facility locations, including remote gas areas. In assessing the transportation fuels market the analysis examined production and use of both conventional and new alternative motor fuels.

0307 Waste Management

Refer also to citation(s) 23092, 23102, 23103, 23127

0308 Environmental Aspects

Refer also to citation(s) 23104, 23725, 23820

23124 (ETDE-DE–177) **Climate-compatible energy supply in Baden-Wuerttemberg. Natural gas.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 15. Hedden, K. (Karlsruhe Univ. (T.H.) (Germany). Engler-Bunte-Institut Bereich 1 - Gas, Erdoel und Kohle); Bott, A.; Klensch, S.; Opper, W. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 75p. (In German). Order Number DE95795824. Source: OSTI; NTIS (US Sales Only).

The study investigates the possibilities of reducing CO_2 emissions in Baden-Wuerttemberg by an enhanced use of natural gas. It intends to find out whether the projected goal of a 25% reduction from 1990 to 2005 can be achieved in this way. First, the state of the art of natural gas supply and use in Baden-Wuerttemberg is characterized, and future trends in this field are outlined. Further, the technical potential of CO_2 reduction by the use of natural gas is investigated on the basis of a few selected examples. The cost of the conversion to natural gas is assessed, and the effects on supply reliability, environmental protection and the labour market are assessed. (orig.)

23125 (GRI–94/0227) **Ecological effects of pipeline construction through deciduous forested wetlands, Midland County, Michigan. Topical report, October 1990–August 1992.** Rastorfer, J.R. (Chicago State Univ., IL (United States). Dept. of Biological Sciences); Van Dyke, G.D.; Zellmer, S.D.; Wilkey, P.L. Institute of Gas Technology, Chicago, IL (United States); Argonne National Lab., IL (United States). Apr 1995. 275p. Sponsored by Gas Research Inst., Chicago, IL (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015664. Source: OSTI; NTIS; GPO Dep.

This study is designed to record vegetational changes induced by the construction of a large-diameter gas pipeline through deciduous forested wetlands. Two second-growth wetland sites mapped Lenawee soils were selected in Midland County, Michigan: Site 1, a younger stand subjected to recent selective logging, and Site 2, a more mature stand. The collection of ecological data to analyze plant succession on the right-of-way (ROW) and the effects of the developing ROW plant communities on adjacent forest communities was initiated in 1989. Cover class estimates were made for understory and ROW plant species on the basis of 1 × 1–m quadrats. Individual stem diameters and species counts were recorded for overstory plants in 10–m quadrats. Although long-term studies have not been completed, firm baseline data were established for comparative analyses with future sampling. Current data indicate that vegetation became well-established on the ROW within one year and subsequently increased in coverage. About 65% of the species were wetland indicators, and the dominants included seeded and natural invading species; nevertheless, some elements of the original flora regenerated and persist. The plants of the ecotone understories of both sites changed from their original composition as a result of the installation of the gas pipeline. Although some forest species persist at both sites, the ecotone of Site I was influenced more by the seeded species, whereas the natural invaders were more important at Site 2.

0320 Transport, Handling, and Storage

Refer also to citation(s) 23128

23126 (DOE/MC/31112–95/C0488) **Field verification of new and novel fracture stimulation technologies for the revitalization of existing underground gas storage wells.** Reeves, S.R.

Advanced Resources International, Inc., Arlington, VA (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-94MC31112. (CONF-950494–30: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95014340. Source: OSTI; NTIS; GPO Dep.

Improved, more efficient natural gas transmission and deliverability systems will be essential for meeting the expected growth in U.S. gas demand in coming decades. Role of gas storage will be important. The most cost-effective means for providing the additional seasonal storage capacity and peak-day deliverability is to improve efficiency of the existing gas storage system (370 gas storage facilities and 17,000 gas storage wells). Up to 5 new fracture stimulation techniques will be field tested. Test sites have been acquired for the 1995 RD&D program.

0330 Properties and Composition

Refer also to citation(s) 23957, 23958, 23959, 23960

0340 Combustion

Refer also to citation(s) 23820, 23885

23127 (DOE/AL/87310–1) **A study of NO_x reduction by fuel injection recirculation. Topical report, January 1995–May 1995.** Turns, S.R.; Feese, J.J.; Frenklach, M.Y. Pennsylvania State Univ., University Park, PA (United States). Jul 1995. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG04-95AL87310. Order Number DE95014709. Source: OSTI; NTIS; GPO Dep.

Flue-gas recirculation (FGR) is a well-known method used to control oxides of nitrogen (NO_x) in industrial burner applications. Recent small- and large-scale experiments by Carnot (Tustin, CA) have shown that introducing the recirculated flue gases with the fuel results in a much greater reduction in NO_x, per unit mass of gas recirculated, in comparison to introducing the flue gases with the combustion air. That fuel injection recirculation (FIR) is more effective than windbox FGR is quite remarkable. At present, however, there is no definitive understanding of why FIR is more effective than conventional FGR. One speculation is that introducing the diluent gases on the fuel side of the flame affects the prompt-NO mechanism causing the greater effectiveness. The objective of our research is to ascertain whether or not chemical and/or molecular transport effects alone can explain the differences in NO_x reduction observed between FIR and FGR. This knowledge will aid in the rational application and optimization of FIR in a wide variety of industrial applications. A combined modeling and experimental program is in progress to achieve the research objectives. This report discusses computer modeling studies of counterflow diffusion flames employing detailed chemical kinetics for fuel (hydrogen or methane) combustion and NO_x formation. These simulations allow the calculation of NO_x emission indices for a wide range of conditions. Parametric studies were conducted in which the diluent was added either on the fuel or air side of the flame for a wide range of flow conditions. Preliminary results from these simulation studies indicate that a major factor in FIR effectiveness is the differential effect on flame zone residence times associated with fuel-side versus air-side dilution.

23128 (DOE/BC/14971–3) **Liquid natural gas as a transportation fuel in the heavy trucking industry. Third quarterly progress report, January 1, 1995–March 31, 1995.** Sutton, W.H. Oklahoma Univ., Norman, OK (United States). Dept. of Aerospace and Mechanical Engineering. Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-94BC14971. Order Number DE95014954. Source: OSTI; NTIS; GPO Dep.

Investigations are underway concerning the use of liquid natural gas as a fuel for trucks. Progress is reported in the following areas: direct diesel replacement and short and long term storage.

05 NUCLEAR FUELS

Refer also to citation(s) 23537

23129 (WSRC-TR–94-100-10) **Savannah River Technology Center monthly report – October 1994.** Westinghouse Savannah River Co., Aiken, SC (United States). Oct 1994. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95014729. Source: OSTI; NTIS; GPO Dep.

Summaries are given for the progress on the following projects: Influence of metallurgical condition on embrittlement of Type 316 SS by internal helium at 820 C; 233-H in-bed accountability support; Hydride container for longterm tritium storage; Reservoir welding and cleaning; Anion exchange; Surplus fissile material control and disposition program–Immobilization pretreatment; Characterization of solids from tanks 12.1 and 18.3; Ce and Uranium purification of Russian Pu-238 via anion exchange; Geology bibliography database; Tree ring tritium chronology; F- and H-Area seepage basin groundwater treatment; Summary of ecological investigations at Savannah River burial ground complex; Consortium for environmental risk evaluation; EPA guidance for ecological risk assessment; Tree kill zone vegetation assessment: F- and H-Area seepage basins; E-Area vault radiological performance assessment approved; National Council of the Paper Industry for air and stream improvement visit; Defense Nuclear Facilities Safety Board review of transuranic and low-level waste; Offgas Components Test Facility quench test completed; Sodium tetraphenylborate stability; Transfer of salt solution from tank 38H to 48H; Transient backpulse model for late wash; High-level waste integrated flowsheet model; SPEEDUP lower flammability level model; Thermal Fluid Laboratory melter feed test; Mixing consultants visits to SRS; FRR spent fuel dry storage development; Separations Equipment Development Facility decontamination and decommissioning activities; and Change control status.

0501 Reserves, Exploration, and Mining

Refer also to citation(s) 24720

0504 Feed Processing

Refer also to citation(s) 23317, 24568

0505 Uranium Enrichment

23130 (POEF-SH–31) **Calculated in-air leakage spectra and power levels for the ANSI standard minimum accident of concern. Final report.** Lee, B.L. Jr.; Dobelbower, M.C.; Tayloe, R.W. Jr. Oak Ridge National Lab., TN (United States). Jul 1995. 147p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00001. Order Number DE95014999. Source: OSTI; NTIS; INIS; GPO Dep.

This document represents Phase I of a two-phase project. The entire project consists of determining a series of minimum accidents of concern and their associated neutron and photon leakage spectra that may be used to determine Criticality Accident Alarm compliance with ANSI/ANS-8.3. The inadvertent assembly of a critical mass of material presents a multitude of unknown quantities. Depending on the particular process, one can make an educated guess as to fissile material. In a gaseous diffusion cascade, this material is assumed to be uranyl fluoride. However, educated assumptions cannot be readily made for the other variables. Phase I of this project is determining a bounding minimum accident of concern and its associated neutron and photon leakage spectra. To determine the composition of the bounding minimum accident of concern, work was done to determine the effects of geometry, moderation level, and enrichment on the leakage spectra of a critical assembly. The minimum accident of concern is defined as the accident that may be assumed to deliver the equivalent of an absorbed dose in free air of 20 rad at a distance of 2 meters from the reacting material within 60 seconds. To determine this dose, an analyst makes an assumption and choose an appropriate flux to dose response function. The power level required of a critical assembly to constitute a minimum accident of concern depends heavily on

the response function chosen. The first step in determining the leakage spectra was to attempt to isolate the effects of geometry, after which all calculations were conducted on critical spheres. The moderation level and enrichment of the spheres were varied and their leakage spectra calculated. These spectra were then multiplied by three different response functions: the Henderson Flux to Dose conversion factors, the ICRU 44 Kerma in Air, and the MCNP Heating Detector. The power level required to produce a minimum accident of concern was then calculated for each combination.

0507 Fuels Production and Properties

Refer also to citation(s) 23381, 24356

23131 (DOE/ER/75388–T1) **HEU to LEU fuel conversion. Final report.** Mulder, R.U. Virginia Univ., Charlottesville, VA (United States). School of Engineering and Applied Science. Oct 1994. 731p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER75388. Order Number DE95015477. Source: OSTI; NTIS; INIS; GPO Dep.

The Nuclear Regulatory Commission issued a ruling, effective March 27, 1986, that all U.S. non-power reactors convert from HEU fuel to LEU fuel. A Reduced Enrichment for Research and Test Reactors Program was conducted by the Department of Energy at Argonne National Laboratory to coordinate the development of the high density LEU fuel and assist in the development of Safety Analysis Reports for the smaller non-power reactors. Several meetings were held at Argonne in 1987 with the non-power reactor community to discuss the conversion and to set up a conversion schedule for university reactors. EG&G at Idaho was assigned the coordination of the fuel element redesigns. The fuel elements were manufactured by the Babcock & Wilcox Company in Lynchburg, Virginia. The University of Virginia was awarded a grant by the DOE Idaho Operations Office in 1988 to perform safety analysis studies for the LEU conversion for its 2 MW UVAR and 100 Watt CAVALIER reactors. The University subsequently decided to shut down the CAVALIER reactor. A preliminary SAR on the UVAR, along with Technical Specification changes, was submitted to the NRC in November, 1990. An updated SAR was approved by the NRC in January, 1991. In September, 1992, representatives from the fuel manufacturer (B&W) and the fuel designer (EG&G, Idaho) came to the UVAR facility to observe trial fittings of new 22 plate LEU mock fuel elements. B&W fabricated two non-fuel bearing elements, a regular 22 plate element and a control rod element. The elements were checked against the drawings and test fitted in the UVAR grid plate. The dimensions were acceptable and the elements fit in the grid plate with no problems. The staff made several suggestions for minor construction changes to the end pieces on the elements, which were incorporated into the final design of the actual fuel elements. Selected papers are indexed separately for inclusion in the Energy Science and Technology Database.

23132 (DOE/SF/20218–T2) **Plutonium Consumption Program, CANDU Reactor Project: Feasibility of BNFP Site as MOX Fuel Supply Facility. Final report.** AECL Technologies, Inc., Rockville, MD (United States). 30 Jun 1995. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-94SF20218. Order Number DE95014327. Source: OSTI; NTIS; GPO Dep.

An evaluation was made of the technical feasibility, cost, and schedule for converting the existing unused Barnwell Nuclear Fuel Facility (BNFP) into a Mixed Oxide (MOX) CANDU fuel fabrication plant for disposition of excess weapons plutonium. This MOX fuel would be transported to Ontario where it would generate electricity in the Bruce CANDU reactors. Because CANDU MOX fuel operates at lower thermal load than natural uranium fuel, the MOX program can be licensed by AECB within 4.5 years, and actual Pu disposition in the Bruce reactors can begin in 2001. Ontario Hydro will have to be involved in the entire program. Cost is compared between BNFP and FMEF at Hanford for converting to a CANDU MOX facility.

23133 (HW–19758) **Spectrographic analyses of 234-5 Building product.** Weidenbaum, B. Hanford Works, Richland, WA (United States). 20 Dec 1950. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014047. Source: OSTI; NTIS; GPO Dep.

Spectrographic analyses of plutonium metal are discussed.

23134 (HW–21195) **Magnesia specifications and estimated quantity of magnesia in the 234-5 Building Crucible Shop.** Anicetti, R.J. Hanford Works, Richland, WA (United States). 24 May 1951. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014049. Source: OSTI; NTIS; GPO Dep.

Short communication. MAGNESIUM OXIDES/specifications; CRUCIBLES/fabrication; SPECIFICATIONS; CRUCIBLES; FABRICATION; GRAIN SIZE; CHEMICAL ANALYSIS

23135 (HW–24084) **234-5 Building RM line equipment tests, Task III mixer.** Collins, P.E. Hanford Works, Richland, WA (United States). 10 Apr 1952. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013931. Source: OSTI; NTIS; GPO Dep.

Several operations that are important to the process as carried out in Task III (Reduction) are performed by the mixer. In order to specify the process certain tests were made to study these operations and are discussed in this report. They include: Mixing Time, Mixer Discharge Rate, Mixer Holdup, and Mixer Capacity. A description of the test, conclusions and recommendations is provided.

23136 (HW–24740) **Production of "X" buttons in the 234-5 Building.** Collins, P.E. Hanford Works, Richland, WA (United States). 12 Jun 1952. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013936. Source: OSTI; NTIS; GPO Dep.

Short communication. PLUTONIUM/production; TAILINGS/recycling; PLUTONIUM; PRODUCTION; TAILINGS; RECYCLING; MACHINING; SAFETY; MIXERS

23137 (HW–26450) **Production Test 234-5 plant process evaluation precipitation of plutonium IV oxalate.** Kerr, W.B. General Electric Co., Richland, WA (United States). Nucleonics Div. 3 Dec 1952. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014115. Source: OSTI; NTIS; GPO Dep.

The object of the work described in this report was to adapt the laboratory procedures for precipitating and hydrofluorinating plutonium (IV) oxalate to plant equipment on 160 and 350 gram scale. This adaptation was done by making minor process changes in concentration, digestion time, rate of chemical addition, etc.

23138 (HW–59743) **Recuplex prototype anion exchange column.** Smith, R.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 27 Mar 1959. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014063. Source: OSTI; NTIS; GPO Dep.

Short communication. PLUTONIUM NITRATES/impurities; PLUTONIUM/materials recovery; IMPURITIES; PLUTONIUM; RECYCLING; ION EXCHANGE MATERIALS; ANIONS; RESINS; ION EXCHANGE; SEPARATION PROCESSES; EXTRACTION COLUMNS; RADIOACTIVE WASTES

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Refer also to citation(s) 23260, 23374, 23380, 23387, 23857

23139 (HW–25042) **Service of reduction bombs, Plutonium Purification and Fabrication, 234-5 Building.** Ward, R. Hanford Works, Richland, WA (United States). 16 Jul 1952. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015189. Source: OSTI; NTIS; GPO Dep.

This report presents information pertaining to the life of the reduction bombs in both the RG and RMM Lines of the Plutonium Purification and Fabrication operations in the 234-5 Building. The expected average life to rupture of the RG Line Bomb of carbon steel subjected to an internal pressure of 450 psig is ten hours at 750 C. The expected average life of the RM Line bomb of V-36 alloy is more than 100,000 hours at 750 C under the same operating

conditions. These expected average life values do not include any calculated factor of safety. Since they are average figures, some bombs could be expected to have shorter life to rupture. The BG Line bomb of carbon steel is definitely hazardous under the extreme service conditions of 450 psig and 750 C. If the use of carbon steel is to be continued it is recommended that the bombs be redesigned to reduce unit stresses.

23140 (JAERI-Research–95-030) **Research on fretting corrosion behavior of structural materials used in nitric acid environments for spent fuel reprocessing. 1. Difference in fretting corrosion resistance among austenitic stainless steel, Ti and Zr.** Sakairi, Masatoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kiuchi, Kiyoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 39p. (In Japanese). Order Number DE95789391. Source: OSTI; NTIS; INIS.

The pin on disk type rotating wear apparatus was used to study the difference of fretting corrosion resistance among type 304ULC austenitic stainless steel (SUS) and refractory metals of zirconium (Zr) and titanium (Ti) immersed in 3N HNO_3 at room temperature. In this experiment, the weight loss of pin and disk increased with time. Comparing with the pin abraded constantly, the disk was repeatedly faced on the removal and the repassivation of the surface film. The thickness loss rate of Zr both pin and disk were larger than that of Ti and SUS. The controlling factors on the corrosion wear of Zr is considered to be mechanically scribing off the metal. A possible reason for corrosion wear difference between Ti and Zr may be dependent on following feature of Zr. Zr has a weak mechanical strength along the specific crystal planes due to hcp type structure and the slow repassivation rate in 3N HNO_3. (author).

23141 (JAERI-Tech–95-016) **Study on the photoacoustic spectroscopy capabilities with remote detection for monitoring of actinide species in nuclear fuel reprocessing solutions.** Sinkov, S.I. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kihara, Takehiro; Fujine, Sachio; Maeda, Mitsuru. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 54p. Order Number DE95789324. Source: OSTI; NTIS; INIS.

A LIPAS (Laser Induced Photoacoustic Spectroscopy) system has been developed for remote analysis of weakly absorbing species in solution. A number of photoacoustic cells of various configurations have been examined in remote arrangement of PA spectrometer with application of an optical fiber for the laser light transmission to PA cell. A microscope objective was tested in optical fiber launching arrangement to collimate laser beam after the fiber. It has been shown that short optical pathlengh cuvette type cells in combination with a disk type piezoelectric transducer (PZT) are superior to previously used cylindrical PA cell with a tube type PZT as regards more effective elimination of scattered and reflected light contribution to PZT response. This allows to improve the linearity of calibration curve and to lower the detection limit absorptivity down to $4.2 \times 10^{-5} cm^{-1}$, which has been evaluated using an absorption band of Nd at 511.4 nm. The newly designed PA cell has been applied for investigation of PAS capabilities to detection of Pu(III), Pu(IV) and Pu(VI) simulated species in uranium containing solutions relevant to the nuclear fuel reprocessing technology. It has been shown that the proper selection of plutonium absorption band for each oxidation state allows to reduce high background contribution from U(VI) ions to the analytical PA signal and to keep detection limit absorptivity within a $1\text{-}3 \times 10^{-5} cm^{-1}$ range in the 525-562 nm wavelength region. (author).

23142 (JAERI-Tech–95-024) **Safety demonstration tests of air-ventilation system for the postulated explosive burning in a cell of fuel-reprocessing plant.** Takada, Junichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Suzuki, Motoe; Tukamoto, Michio; Koike, Tadao; Nishio, Gunji. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 348p. (In Japanese). Order Number DE95789392. Source: OSTI; NTIS; INIS.

Safety demonstration tests of an explosive burning in a cell in the reprocessing plant has been carried out in JAERI under the auspices of the Science and Technology Agency, to evaluate the safety of an air-ventilation system during the hypothetical explosion. The postulated explosive burning of organic solvent mixed with nitric acid was simulated by solid explosives. The demonstration test was performed using an industrial scale experimental facility simulating to the ventilation system of the large scale reprocessing plant in JAPAN. Propagations of pressure, temperature, and gas velocity through cells and ducts in the ventilation system were measured during the explosive burning under deflagration. Experimental data in this report can be used to evaluate the transport phenomena of radioactive materials in the ventilation system during the explosion, and also to verify computer code CELVA for the safety analysis of ventilation system in the event of explosion accidents. (author).

23143 (JAERI-Tech–95-027) **Distribution behavior of 1-butanol in reprocessing solution.** Asakura, Toshihide (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nemoto, Hideyuki; Uchiyama, Gunzo; Fujine, Sachio; Maeda, Mitsuru. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 44p. (In Japanese). Order Number DE95789315. Source: OSTI; NTIS; INIS.

The distribution behavior of 1-butanol was studied under PUREX process conditions, using the two phase system of the organic solution of tributyl phosphate (TBP) and dodecane, and of the aqueous solution of nitric acid and uranyl nitrate. The distribution ratio of 1-butanol was measured by changing the concentration of 1-butanol, the concentration of TBP in the organic phase, the concentration of uranium in the organic phase, and the concentration of nitric acid in the aqueous phase. The ratios varied from 0.09 to 5 under the present experimental conditions. (author).

23144 (JAERI-Tech–95-029) **Thermochemical test of solvent in nuclear fuel reprocessing plants.** Nishio, Gunju (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Koike, Tadao; Takada, Junichi; Watanabe, Kouzou; Miyata, Sadajirou. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 65p. (In Japanese). Order Number DE95789347. Source: OSTI; NTIS; INIS.

In a Russian reprocessing plant in Tomsk, an explosive event occurred on April 6, 1993 due to pressurization of a tank containing uranyl nitrate solution by a rapid thermal decomposition of solvent with nitric acid. This event shows a singular reaction behavior that a large amount of heat is evolved under a boiling point (121degC) of nitric acid solution, even though a valve at the exhaust pipe of tank is reported to be opened. Accumulation of unstable decomposition materials is inferred in the tank due to a degradation of solvent caused by reactions with nitric acid. The chemical analysis of the degraded solvent was performed and chemical forms of these decomposition materials were identified. Also, the reaction heat of these materials was measured by a differential thermal analyzer (DTA) and a differential scanning calorimeter (DSC). (author).

23145 (WHC-SA–2856) **Using digital systems to control air pulsers.** Silvan, G.R. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-951048–1: International conference and exhibit of the Instrument Society of America, New Orleans, LA (United States), 2-5 Oct 1995). Order Number DE95011636. Source: OSTI; NTIS; INIS; GPO Dep.

Air pulsing is a standard method used at the Hanford Site for enhancing the efficiency of sieve tray columns. Air is injected into the base of the column and then vented using a latching solenoid valve. This "shaking" action increases the contact between the two liquid phases in the column. The existing analog speed controllers can vary the pulse rate from 0 to 100 pulses per minute. The controllers are nonlinear, and replacement with digital controllers is desired. Simulator tests, however, showed erratic results when a digital controller was used. This was traced to the scan time of the controller. The 0.1 second scan rate of the controller, although fast enough to control at 100 pulses per minute, could not handle small setpoint changes. This was especially true at the high end of the range, and was due to the integer relationship created by the scan time. Using a controller specially modified to scan every 0.01 second will lessen the problem. This experience has shown that resolution, as well as maximum rate, should be considered when specifying scan rates requirements for digital controllers.

23146 (WHC-SD-CP-OTR–152) **Closed loop cooling operation with MICON.** Navarro, G.E. Westinghouse Hanford Co., Richland, WA (United States). 11 May 1995. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012580. Source: OSTI; NTIS; INIS; GPO Dep.

This Operability Test Procedure (OTP) provides instructions for testing the Closed Loop Cooling System interface with the MICON Terminal at the Plutonium Finishing Plant located at the 200 West Area of the Hanford Site. The Closed Loop Cooling System consists of several primary loops and a single secondary cooling loop. The test objectives are to functionally prove the interlocks and instruments of the closed loop cooling system with the MICON and to show operability of the system from the MICON Terminal. Any out of tolerance readings during the test will be adjusted immediately or with a new calibration package at a later time per cognizant engineers direction.

23147 (WHC-SD-CP-TP–085) **Test plan for anion exchange testing with Argonne 10-L solutions.** Compton, J.A. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012579. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this test plan is to determine the performance characteristics of four anion exchange resins. This information is required to scale up an ion exchange process for removing undesirable chemicals from calciner feed at PFP. The performance characteristics will be judged by comparing the total exchange capacity, the sorption and desorption of plutonium, the distribution coefficient, and other operating information in the presence of various complexing anions. The results will be compared to a similar process using organic extractants to determine the best way of removing the undesirable chemicals from the plutonium solutions.

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Refer also to citation(s) 23265, 23326, 23376

23148 (ANL/ET/CP–83253) **Capabilities for spent fuel characterization at Argonne National Laboratory.** Neimark, L.A.; Strain, R.V. Argonne National Lab., IL (United States). Oct 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-941207–37: Spent nuclear fuel meeting: challenges and initiatives, Salt Lake City, UT (United States), 14-16 Dec 1994). Order Number DE95012532. Source: OSTI; NTIS; INIS; GPO Dep.

Summaries of the status of spent nuclear fuel (SNF) owned by the Department of Energy have highlighted the need to obtain a better understanding of the current physical and chemical condition of the SNF as a foundation for establishing a clear path forward for the fuel's eventual geologic disposal in a long-term repository. To initiate obtaining the required information, DOE has generated an SNF Characterization Plan based on the needs for characterizing the materials stored at the individual major DOE storage sites. The principal focus of the plan is to characterize those fuel attributes that are key to the safe handling, transportation, and storage of the SNF. The drivers for specific attributes are regulatory requirements, resolution of technical issues, or a design need. Argonne National Laboratory's facilities in Illinois and Idaho possess capabilities that can be used to address many of the characterization issues that have been raised. This paper will describe these capabilities.

23149 (DOE/RW–0425-Suppl.) **Transportation system requirements document. Revision 1 DCN01. Supplement.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). May 1995. 35p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013315. Source: OSTI; NTIS; INIS; GPO Dep.

The original Transportation System Requirements Document described the functions to be performed by and the technical requirements for the Transportation System to transport spent nuclear fuel (SNF) and high-level radioactive waste (HLW) from Purchaser and Producer sites to a Civilian Radioactive Waste Management System (CRWMS) site, and between CRWMS sites. The purpose of that document was to define the system-level requirements. These requirements include design and operations requirements to the extent they impact on the development of the physical segments of Transportation. The document also presented an overall description of Transportation, its functions, its segments, and the requirements allocated to the segments and the system-level interfaces with Transportation. This revision of the document contains only the pages that have been modified.

23150 (ORNL/TM–13012) **Prediction of external corrosion for UF_6 cylinders: Results of an empirical method.** Lyon, B.F. Oak Ridge National Lab., TN (United States). Jun 1995. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014488. Source: OSTI; NTIS; INIS; GPO Dep.

Wall thickness data for depleted LTF, (DU) cylinders in above-ground storage at three Department of Energy (DOE) sites (Oak Ridge, TN; Paducah, KY; Portsmouth, OH) were analyzed in order to address the following questions: How many cylinders may have breaches now? and, What will the conditions be like in 2020? This report summarizes preliminary results of the analyses conducted. These results are to be used as input into models for estimating risks and hazards associated with the cylinders in the various conditions. These models will then be used as a basis for implementing engineering fixes where possible and for management decisions on corrective actions. This is part of the overall assessment of the risks and hazards within the DU management program.

23151 (WHC-SD-FF-CSER–004) **Criticality safety evaluation for long term storage of FFTF fuel in interim storage casks.** Richard, R.F. Westinghouse Hanford Co., Richland, WA (United States). 11 May 1995. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012576. Source: OSTI; NTIS; INIS; GPO Dep.

It has been postulated that a degradation phenomenon, referred to as "hot cell rot", may affect irradiated FFTF mixed plutonium-uranium oxide (MOX) fuel during dry interim storage. "Hot cell rot" refers to a variety of phenomena that degrade fuel pin cladding during exposure to air and inert gas environments. It is thought to be a form of caustic stress corrosion cracking or environmentally assisted cracking. Here, a criticality safety analysis was performed to address the effect of the "hot cell rot" phenomenon on the long term storage of irradiated FFTF fuel in core component containers. The results show that seven FFTF fuel assemblies or six Ident-69 pin containers stored in core component containers within interim storage casks will remain safely subcritical.

23152 (WHC-SD-SNF-ATR–005) **105-KE Isolation Barrier Leak Rate Acceptance Test Report.** McCracken, K.J. Westinghouse Hanford Co., Richland, WA (United States). 14 Jun 1995. 182p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015655. Source: OSTI; NTIS; INIS; GPO Dep.

This Acceptance Test Report (ATR) contains the completed and signed Acceptance Procedure (ATP) for the 105-KE Isolations Barrier Leak Rate Test. The Test Engineer's log, the completed sections of the ATP in the Appendix for Repeat Testing (Appendix K), the approved WHC J-7s (Appendix H), the data logger files (Appendices T and U), and the post test calibration checks (Appendix V) are included.

23153 (WHC-SD-SNF-DQO–004) **Data quality objectives for the initial fuel conditioning examinations.** Lawrence, L.A. Westinghouse Hanford Co., Richland, WA (United States). 23 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014310. Source: OSTI; NTIS; INIS; GPO Dep.

The Data Quality Objectives (DQOs) were established for the response of the first group of fuel samples shipped from the K West Basin to the Hanford 327 Building hot cells for examinations to the proposed Path Forward conditioning process. Controlled temperature and atmosphere furnace testing testing will establish performance parameters using the conditioning process (drying, sludge drying, hydride decomposition passivation) proposed by the Independent Technical Assessment (ITA) Team as the baseline.

23154 (WHC-SD-SNF-DTP–001) **Test procedure for the Master-Lee and the modified Champion four inch hydraulic cutters.** Crystal, J.B. Westinghouse Hanford Co., Richland, WA (United States). 2 May 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012569. Source: OSTI; NTIS; INIS; GPO Dep.

The Master-Lee and the modified Champion 4 Inch hydraulic cutters are being retested to gather and document information related to the following: determine if the Master-Lee cutters will cut the trunnions of an Aluminum fuel canister and a Stainless Steel fuel canister; determine if the Master-Lee cutters will cut $1\frac{1}{2}$ inch diameter fire hose; determine if the modified Champion 4 inch blade will cut sections of piping; and determine the effectiveness of the centering device for the Champion 4 Inch cutters. Determining the limitations of the hydraulic cutter will aid in the process of debris removal in the K-Basin. Based on a previous test, the cutters were returned to the manufacturer for modifications. The modifications to the Champion 4 Inch Cutter and further testing of the Master-Lee Cutter are the subjects of these feature tests.

23155 (WHC-SD-SNF-SP–001) **Westinghouse Hanford Company recommended strategy for K Basin sludge disposition.** Alderman, C.J. Westinghouse Hanford Co., Richland, WA (United States). 1 May 1995. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012570. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this document is to present the recommended strategy for removal of sludges from the K Basins. This document ties sludge removal activities to the plan for the K Basin spent nuclear fuel (SNF) described in WHC-EP-0830, Hanford Spent Nuclear Fuel Project Recommended Path Forward and is consistent with follow-on direction provided in February 1995. Solutions and processes for resolving sludge removal technical and management issues to meet accelerated K Basin deactivation objectives are described. The following outlines the major elements of the recommendation: (1) manage all sludges as SNF while in the K Basins; (2) once loose sludges are collected and removed from the facilities, manage them as radioactive or mixed waste consistent with the upcoming characterization results, the preferred sludge path forward alternative sends sludges to the Tank Waste Remediation System (TWRS) and/or the Hanford Solid Waste Disposal as appropriate; (3) continue to manage sludge within the fuel canisters at the time they are loaded into the multi-canister overpacks as SNF.

23156 (WHC-SD-TP-SWD–002-Rev.2) **Automated Transportation Management System (ATMS) Software Project Management Plan (SPMP). Revision 2.** Weidert, R.S. Westinghouse Hanford Co., Richland, WA (United States). 26 May 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014432. Source: OSTI; NTIS; INIS; GPO Dep.

As a cabinet level federal agency with a diverse range of missions and an infrastructure spanning the United States, the US Department of Energy (DOE) has extensive freight transportation requirements. Performance and management of this freight activity is a critical function. DOE's Transportation Management Division (TMD) has an agency-wide responsibility for overseeing transportation activities. Actual transportation operations are handled by government or contractor staff at the field locations. These staff have evolved a diverse range of techniques and procedures for performing transportation functions. In addition to minimizing the economic impact of transportation on programs, facility transportation staff must be concerned with the increasingly complex task of complying with complex shipment safety regulations. Maintaining the department's safety record for shipping hazardous and radioactive materials is a primary goal. Use of automation to aid transportation functions is not widespread within DOE, though TMD has a number of software systems designed to gather and analyze data pertaining to field transportation activities. These systems are not integrated. Historically, most field facilities have accomplished transportation-related tasks manually or with minimal computer assistance. At best, information and decision support systems available to transportation staffs within the facilities are fragmented. In deciding where to allocate resources for automation, facility managers have not tended to give the needs of transportation departments a high priority. This diversity causes TMD significant difficulty in collecting data for use in managing department-wide transportation activities.

23157 (WHC-SD-W236A-DA–002) **Stress analysis of single port (ISB) jumper connectors for 2-, 3-, and 4-in. sizes.** Islam, M.A. (ICF Kaiser Hanford Co., Richland, WA (United States)); Julyk, J.L.; Weiner, E.O. Westinghouse Hanford Co., Richland, WA (United States); ICF Kaiser Hanford Co., Richland, WA (United States). 26 May 1995. 652p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014428. Source: OSTI; NTIS; INIS; GPO Dep.

Jumper connectors are used in the Hanford site for remotely connecting jumper pipe lines in the radioactive zones. The jumper pipes are used for transporting radioactive fluids and hazardous chemicals. This report evaluates the adequacy and the integrity of the 2-, 3-, and 4-in. single-port integral seal block (ISB) jumper connector assemblies, as well as the three-way 2-in. configuration. The evaluation considers limiting forces from the piping to the nozzle. A stress evaluation of the jumper components (hook, hook pin, operating screw, nozzle and nozzle flange, and block) under operational (pressure, thermal, dead weight, and axial torquing of the jumper) and seismic loading is addressed in the report.

23158 (WHC-SD-WM-MAR–007) **Waste Encapsulation and Storage Facility mission analysis report.** Lund, D.P. Westinghouse Hanford Co., Richland, WA (United States). 24 May 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013879. Source: OSTI; NTIS; INIS; GPO Dep.

This report defines the mission for the Waste Encapsulation and Storage Facility (WESF). It contains summary information regarding the mission analysis which was performed by holding workshops attended by relevant persons involved in the WESF operations. The scope of the WESF mission is to provide storage of Cesium (Cs) and Strontium (Sr) capsules, previously produced at WESF, until every capsule has been removed from the facility either to another storage location, for disposal or for beneficial use by public or private enterprises. Since the disposition of the capsules has not yet been determined, they may be stored at WESF for many years, even decades. The current condition of the WESF facility must be upgraded and maintained to provide for storage which is safe, cost effective, and fully compliant with DOE direction as well as federal, state, and local laws and regulations. The Cs capsules produced at WESF were originally released to private enterprises for uses such as the sterilization of medical equipment; but because of the leakage of one capsule, all are being returned. The systems, subsystems, and equipment not required for the storage mission will be available for use by other projects or private enterprises. Beyond the storage of the Cs and Sr capsules, no future mission for the WESF has been identified.

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Refer also to citation(s) 23148, 23152, 23155, 23157, 23319, 23320, 23321, 23322, 23323, 23326, 23327, 23331, 23332, 23335, 23340, 23341, 23347, 23348, 23353, 23358, 23360, 23365, 23372, 23377, 23386, 23688, 23695, 23797, 23826, 23899, 23900, 23901, 23930, 23946, 23949, 24014, 24565, 24567, 24578, 24590, 24610, 24615, 24932, 25004

23159 (ANL–95/7) **Surveillance of Site A and Plot M report for 1994.** Golchert, N.W. Argonne National Lab., IL (United States). May 1995. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013276. Source: OSTI; NTIS; INIS; GPO Dep.

The results of the environmental surveillance program conducted at Site A/Plot M in the Palos Forest Preserve area for 1994 are presented. The surveillance program is the ongoing remedial action that resulted from the 1976-1978 radiological characterization of the site. That study determined that very low levels of hydrogen-3 (as tritiated water) had migrated from the burial ground and were present in two nearby hand-pumped picnic wells. The current program consists of sample collection and analysis of air, surface and

subsurface water, and bottom sediment. The results of the analyses are used to (1) monitor the migration pathway of water from the burial ground (Plot M) to the hand-pumped picnic wells, (2) establish if buried radionuclides other than hydrogen-3 have migrated, and (3) generally characterize the radiological environment of the area. Hydrogen-3 in the Red Gate Woods picnic wells was still detected this year, but the average and maximum concentrations were significantly less than found earlier. Tritiated water continues to be detected in a number of wells, boreholes, dolomite holes, and a surface stream. For many years it was the only radionuclide found to have migrated in measurable quantities. Analyses since 1984 have indicated the presence of low levels of strontium-90 in water from a number of boreholes next to Plot M. The available data does not allow a firm conclusion as to whether the presence of this nuclide represents recent migration or movement that may have occurred before Plot M was capped. The results of the surveillance program continue to indicate that the radioactivity remaining at Site A/Plot M does not endanger the health or safety of the public visiting the site, using the picnic area, or living in the vicinity.

23160 (ANL/CMT/CP–84524) **Laboratory testing of West Valley reference 6 glass.** Ebert, W.L. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950401–13: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95014235. Source: OSTI; NTIS; INIS; GPO Dep.

A series of laboratory tests is being conducted to characterize the corrosion of West Valley reference 6 glass (WV6) and to provide parametric values for modeling its long-term durability. Models require measurement of the corrosion rate in the absence of corrosion products and in fluids that are "saturated" with corrosion products, and the identification of alteration phases. Corrosion rates in dilute and saturated conditions were measured using MCC-1 and PCT tests, respectively. Vapor hydration tests were performed to generate secondary phases. The PCT tests show the WV6 glass to be more durable than SRL EA, SRL 202, and HW-39-1 glasses. Vapor hydration tests show weeksite (a uranyl silicate), a potassium-bearing zeolite, analcime, potassium feldspar, a calcium silicate phase, and lithium phosphate to form as WV6 glass corrodes. Test results are presented and their relevance to long-term performance discussed.

23161 (ANL/CMT/CP–84526) **Long-term performance of glasses for Hanford low-level waste.** Bakel, A.J. (Argonne National Lab., IL (United States)); Ebert, W.L.; Luo, J.S. Argonne National Lab., IL (United States); Pacific Northwest Lab., Richland, WA (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38 ; AC06-76RL01830. (CONF-950401–15: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95013781. Source: OSTI; NTIS; INIS; GPO Dep.

The long-term performance of glasses developed for stabilizing Hanford low-level radioactive waste is being assessed using static leach tests conducted for up to one year and under conditions that accelerate Corrosion. These tests support development of durable waste-form compositions and application of performance assessment models. Static leach tests were run with crushed glass at glass surface area/solution volume ratios of 2000 and 20,000 m^{-1} and temperatures of 20, 40, 70, and 90°C. All tests showed sodium to be released from the glass faster than boron or silicon. These results are interpreted in terms of the glass structure, the corrosion mechanism, and the effects of time, glass surface area/leachant volume ratio and temperature. Vapor hydration tests were conducted at elevated temperatures (70-200°C) using glasses containing various amounts of SiO_2, Na_2O, B_2O_3, CaO, and Al_2O_3. The response of a glass in these tests is relevant to its durability over very long disposal times. Different responses were observed in the tests: some glasses completely corroded within a few days while others were only slightly corroded. Corrosion led to the formation of analcime and gobbinsite; the corrosion rate increased significantly after these phases formed implications of these test results for the long-term glass durability are discussed.

23162 (ANL/CMT/CP–84590) **Performance of high plutonium-containing glasses for the immobilization of surplus fissile materials.** Bates, J.K.; Emery, J.W.; Hoh, J.C.; Johnson, T.R. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950401–16: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95013773. Source: OSTI; NTIS; INIS; GPO Dep.

Plutonium from dismantled weapons is being evaluated for geological disposal. While a final waste form has not been chosen, borosilicate glass will be one of the waste forms to be evaluated. The reactivity of the reference blend glass containing the standard amount of Pu (~0.01 wt %) to be produced by the Defense Waste Processing Facility (DWPF) is compared to that of glasses made from the same nominal frit composition but doped with 2 and 7 wt % Pu, and also equal mole percentages of Gd_2O_3. The Gd is added to act as a neutron poison to address criticality concerns. The four different glasses have been reacted using the PCT-B method with a SA/V of 20,000 m^{-1} and the Argonne Vapor Hydration Test (VHT) method. Both test methods accelerate the reaction of the glass. PCT-B is used to determine the reactivity of the glass by analyzing the solution and reacted test components, while the VHT is used to evaluate the long-term reactivity of the glass and the distribution of Pu to secondary phases that will control the long-term reaction of the glass. The results of the tests with high levels of Pu are compared to those with the nominal levels to be produced in the standard DWPF glass.

23163 (ANL/CMT/CP–84591) **Long-term test results from a West Valley actinide-doped reference glass.** Fortner, J.A.; Gerding, T.J.; Bates, J.K. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950401–20: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95013693. Source: OSTI; NTIS; INIS; GPO Dep.

Results from drip tests designed to simulate unsaturated conditions in the proposed Yucca Mountain Repository are reported for an actinide-doped glass (reference glass ATM-10) used as a model waste form. These tests have been ongoing for nearly 7 years, with data collected on solution composition (including transuranics), colloid formation and disposition, glass corrosion layers, and solid secondary phases. This test is unique because of its long elapsed time, high content of thorium and transuranics, use of actual groundwater from the proposed site area, use of contact between the glass and sensitized stainless steel in the test, and the variety of analytical procedures applied to the components. Some tests have been terminated, and scanning electron microscopy (SEM) and analytical transmission electron microscopy (AEM) were used to directly measure glass corrosion and identify secondary phases. Other tests remain ongoing, with periodic sampling of the water that had contacted the glass. The importance of integrated testing has been demonstrated, as complex interactions between the glass, the groundwater, and the sensitized stainless steel have been observed. Secondary phases include smectite clay, iron silicates, and brockite. Actinides, except neptunium, concentrate into stable secondary phases. The release of actinides is then controlled by the behavior of these phases.

23164 (ANL/CMT/CP–84717) **Microscopic characterization of crystalline phases in waste forms.** Buck, E.C. (Argonne National Lab., IL (United States)); Dietz, N.L.; Wronkiewicz, D.J.; Bates, J.K.; Millar, A. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950401–10: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95013890. Source: OSTI; NTIS; INIS; GPO Dep.

Transmission electron microscopy (TEM) has been used to determine the microstructure of crystalline phases present in zirconium- and titanium-bearing glass crystalline composite (GCC) waste forms. The GCC materials were found to contain spinels (maghemite), zirconolites, perovskites ($CaTiO_3$) and plagioclase feldspar (anorthite) mineral phases. The structure of the uranium

and cerium-bearing monoclinic zirconolite was characterized by medium resolution TEM imaging and electron and X-ray diffraction (XRD). The phase was found to contain high levels of iron in comparison to Synroc-type zirconolites. Excess zirconium in zirconolite has resulted in martensitic baddeleyite (ZrO_2) formation. Anorthite ($CaAl_2Si_2O_8$) was present as elongated crystallites within a calcium-rich aluminosilicate glass. Lead and iron-bearing anorthite lying along distinct precipitates were occasionally observed within the an crystallographic planes.

23165 (ANL/CMT/CP–86025) **Quantitative SEM/EDS analysis of high-level waste glasses.** Luo, J.S. (and others); Wolf, S.; Ebert, W. Argonne National Lab., IL (United States). Mar 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950865–4: 29. annual meeting of the Microbeam Analysis Society, Breckenridge, CO (United States), 6-11 Aug 1995). Order Number DE95014080. Source: OSTI; NTIS; INIS; GPO Dep.

Silicate glass will be used to stabilize high-level radioactive wastes (HLW) for disposal in a geological repository. The chemical durability of waste glass in the repository will be determined by the nature and progress of the glass-water (underground water) reaction. Aqueous corrosion of HLW glasses is known to result in the chemical alteration of the glass surface and the formation of secondary phases. Accurate quantitative analysis the altered glass surface and the reaction products that form is important for understanding the reaction kinetics and mechanism of glass corrosion. SEM/EDS is a powerful tool to study the alteration of waste-disposal glasses through quantitatively characterizing the reaction products. It is able to detect trace elements at concentrations less than 1 wt.%: for example, Fig. 1 shows the uranium peaks detected by SEM/EDS of a typical simulated waste glass, which contains 0.25 wt.% uranium in the matrix glass according to ICP/MS analysis. Nickel (0.44 wt.%) and chromium (0.47 wt.%) peaks are also clearly distinguishable in the spectrum. However, quantitative analyses of glass compositions are complicated by the lack of well-characterized reference samples having known and homogeneous compositions for candidate waste glasses, which may contain a combination of more than 20 different elements in one matrix. It has been proposed that unreacted glass with known compositions could satisfactorily serve as standards for quantitative analysis of waste-disposal glasses and the secondary phases. The main advantage of using such standards is that they contain all the elements to be analyzed in the homogeneous vitreous matrices. In this paper, we evaluate several reference waste glasses with respect to their suitability as standard samples for quantitative SEM/EDS analysis. The precision and accuracy using such standards for quantitative analysis are also discussed. All the experiments were carried out on a Topeon ABT 60 SEM operating at 20 kV.

23166 (ANL/CMT/CP–86433) **Developing innovative environmental technologies for DOE needs.** Devgun, J.S. (Argonne National Lab., IL (United States)); Sewell, I.O.; DeGregory, J. Argonne National Lab., IL (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950729–7: 30. Intersociety energy conversion conference, Orlando, FL (United States), 30 Jul - 5 aug 1995). Order Number DE95014242. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental restoration and waste management activities at US Department of Energy (DOE) facilities are diverse and complex. Contamination at DOE sites and facilities includes radionuclides, chlorinated hydrocarbons, volatile organic compounds, non-aqueous phase liquids, and heavy metals, among others. Soil and groundwater contamination are major areas of concern and DOE has focused very significant efforts in these areas. Relevant technology development activities are being conducted at DOE's own national laboratories, as well as through collaborative efforts with other federal agencies and the private sector. These activities span research and development (R&D) of new concepts and techniques to demonstration and commercialization of mature technologies. Since 1990, DOE has also supported R&D of innovative technologies through interagency agreements with US Environmental Protection Agency (EPA), US Department of Defense, the National Science Foundation, and others.

23167 (ANL/EA/CP–84766) **Facility accident considerations in the US Department of Energy Waste Management Program.** Mueller, C. Argonne National Lab., IL (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-941102–45: Winter meeting of the American Nuclear Society, Washington, DC (United States), 13-18 Nov 1994). Order Number DE95011818. Source: OSTI; NTIS; INIS; GPO Dep.

A principal consideration in developing waste management strategies is the relative importance of Potential radiological and hazardous releases to the environment during postulated facility accidents with respect to protection of human health and the environment. The Office of Environmental Management (EM) within the US Department of Energy (DOE) is currently formulating an integrated national program to manage the treatment, storage, and disposal of existing and future wastes at DOE sites. As part of this process, a Programmatic Environmental impact Statement (PEIS) is being prepared to evaluate different waste management alternatives. This paper reviews analyses that have been Performed to characterize, screen, and develop source terms for accidents that may occur in facilities used to store and treat the waste streams considered in these alternatives. Preliminary results of these analyses are discussed with respect to the comparative potential for significant releases due to accidents affecting various treatment processes and facility configurations. Key assumptions and sensitivities are described.

23168 (ANL/EQO/VU–86239) **Argonne National Laboratory Internal Appraisal Program environment, safety, health/quality assurance oversight.** Winner, G.L.; Siegfried, Y.S.; Forst, S.P.; Meshenberg, M.J. Argonne National Lab., IL (United States). [1995]. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505225–Summ.: 8. semiannual environmental, safety, and health coordination meeting, Gaithersburg, MD (United States), 23-25 May 1995). Order Number DE95013412. Source: OSTI; NTIS; GPO Dep.

Argonne National Laboratory's Internal Appraisal Program has developed a quality assurance team member training program. This program has been developed to provide training to non-quality assurance professionals. Upon successful completion of this training and approval of the Internal Appraisal Program Manager, these personnel are considered qualified to assist in the conduct of quality assurance assessments. The training program has been incorporated into a self-paced, computerized, training session.

23169 (ANL/EWM/CP–82616) **Preliminary investigation of the 317 Area, ANL-E.** Wescott, J. (Argonne National Lab., IL (United States)); Moos, L.; Remeikis, A. Argonne National Lab., IL (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950225–2: Geoenvironment 2000 meeting, Baton Rouge, LA (United States), 22-24 Feb 1995). Order Number DE95012940. Source: OSTI; NTIS; INIS; GPO Dep.

The 317 Area at Argonne National Laboratory-East (ANL-E) is scheduled to undergo a Resource Conservation and Recovery Act (RCRA) Facility Investigation, Act or RFI. Prior to the formal RFI, a voluntary, preliminary characterization of the 317 Area was conducted by ANL-E. The characterization results were used to formulate the RFI work plan and provided a better focus for the formal investigation. This site presents a difficult engineering challenge. The nature of the waste disposed at this site in the past includes both liquid chemicals and radioactive waste. The 317 Area is classified as a radiologically controlled area because of operations currently performed there. Present Department of Energy policy stipulates that waste material from such an area must be considered radioactive. The possible presence of hazardous constituents in the soil and groundwater would require the investigation-derived waste generated at the site be disposed as radioactive mixed waste. Besides the nature of the waste possibly contaminating this site, the geology of the site poses an equally enigmatic situation. The ANL-E site is located in a region of recessional glacial moraine deposits.

23170 (BNL–61647) **Nondestructive examination of DOE high-level waste storage tanks.** Bush, S.; Bandyopadhyay, K.;

Kassir, M.; Mather, B.; Shewmon, P.; Streicher, M.; Thompson, B.; van Rooyen, D.; Weeks, J. Brookhaven National Lab., Upton, NY (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950740–46: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95011776. Source: OSTI; NTIS; INIS; GPO Dep.

A number of DOE sites have buried tanks containing high-level waste. Tanks of particular interest am double-shell inside concrete cylinders. A program has been developed for the inservice inspection of the primary tank containing high-level waste (HLW), for testing of transfer lines and for the inspection of the concrete containment where possible. Emphasis is placed on the ultrasonic examination of selected areas of the primary tank, coupled with a leak-detection system capable of detecting small leaks through the wall of the primary tank. The NDE program is modelled after ASME Section XI in many respects, particularly with respects to the sampling protocol. Selected testing of concrete is planned to determine if there has been any significant degradation. The most probable failure mechanisms are corrosion-related so that the examination program gives major emphasis to possible locations for corrosion attack.

23171 (CAO–94-1010) **Transuranic Waste Characterization Quality Assurance Program Plan.** USDOE Carlsbad Area Office, NM (United States). 30 Apr 1995. 258p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012993. Source: OSTI; NTIS; INIS; GPO Dep.

This quality assurance plan identifies the data necessary, and techniques designed to attain the required quality, to meet the specific data quality objectives associated with the DOE Waste Isolation Pilot Plant (WIPP). This report specifies sampling, waste testing, and analytical methods for transuranic wastes.

23172 (CONF-950570–21) **Continuous, environmental radon monitoring program at the Yucca Mountain Site Characterization Project.** Liu, N.; Sorensen, C.D.; Tung, C.H.; Orchard, C.R. Science Applications International Corp., Las Vegas, NV (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-87NV10576. From International high-level radioactive waste management conference: progress toward understanding; Las Vegas, NV (United States); 1-5 May 1995. Order Number DE95012123. Source: OSTI; NTIS; INIS; GPO Dep.

A continuous, environmental radon monitoring program has been established in support of the Department of Energy's (DOE) Yucca Mountain Site Characterization Project (YMP). The monitoring program is to characterize the natural radon emissions at the YMP site, to understand the existing radon concentrations in the environmental background, and to assess and control the potential work exposure. Based upon a study of the monitoring results, this paper presents a preliminary understanding of the magnitudes, characteristics, and exposure levels of radon at the YMP site.

23173 (CONF-950570–24) **Anisotropy of mechanical properties of tuff at Yucca Mountain.** Karakouzian, M.; Hudyma, N. Nevada Univ., Las Vegas, NV (United States). [1995]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC08-90NV10872. From International high-level radioactive waste management conference: progress toward understanding; Las Vegas, NV (United States); 1-5 May 1995. Order Number DE95013014. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this study is to investigate anisotropy of mechanical properties, namely, compressive strength and modulus, for Tiva Canyon welded tuff from the starter tunnel at Yucca Mountain. Mechanical properties of Tiva Canyon Tuff are needed for the design of the ramps and drifts within the Tiva Canyon horizon. Approximately one cubic foot block samples, all of which were from the thermo – mechanical unit TCw, were obtained from a muck pile containing excavated rock from the starter tunnel. Specimens were cored from the block samples in two distinct orientations: parallel and perpendicular to the lithophysal cavity orientation. Since lithophysal cavity orientation is predominantly horizontal in the field, parallel specimens can be considered horizontal and perpendicular specimens vertical with respect to the rock mass. The specimens were NX sized (5.4 cm diameter) and had a length-to-diameter ratio of 2:1. The air dried specimens were tested at room temperature in a triaxial chamber at confining pressures of 0.1, 5, and 10 MPa, and at a compressive axial strain rate of 10^{-5} s^{-}. The Young's Modulus values were calculated by a least squares fit of stress - strain data between 10 and 50% of the ultimate strength.

23174 (CONF-9505101–5) **Waste processing demonstrations within the Waste Pretreatment and Processing Program of the Tank Focus Area.** Hunt, R.D.; McGinnis, C.P. Oak Ridge National Lab., TN (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Conference on challenges and innovations in the management of hazardous waste; Washington, DC (United States); 10-12 May 1995. Order Number DE95013984. Source: OSTI; NTIS; INIS; GPO Dep.

US Department of Energy (DOE) Office of Environmental Management has created a new approach for the development of technology for DOE environmental remediation problems. Previously, technology development was conducted on a site-by-site basis and managed by multiple organizations. This new DOE strategy consolidates and focuses all technology development efforts on five priority problems. The remediation of the 1×10^8 gal of radioactive waste in the underground storage tanks (USTs) at five DOE sites is one of the priority problems. All tank remediation projects will be integrated into the Tank Focus Area (TFA). The TFA mission is to manage an integrated technology development program that results in the safe and efficient remediation of UST waste across the DOE complex. The TFA has divided its efforts into several areas such as safety, characterization, retrieval, pretreatment and processing, immobilization, and site closure. A key predecessor of the Waste Pretreatment and Processing Program (WPPP) of the TFA was the Waste Processing and Disposal Program (WPDP) of the Underground Storage Tank – Integrated Demonstration. Nearly all of the FY 1995 WPDP projects have been transferred into the WPPP. These WPPP projects can be divided into four systems: cesium removal, comprehensive sludge and supernate, out-of-tank evaporation, and cross-flow filtration. The current status of these WPPP projects is presented. The goal of the projects is to minimize the volume of high-level waste and the radioactivity in low-level waste.

23175 (CONF-9505101–6) **Removal of technetium from alkaline nuclear-waste media by a solvent-extraction process using crown ethers.** Bonnesen, P.V. (Oak Ridge National Lab., TN (United States). Chemical and Analytical Sciences Div.); Presley, D.J.; Haverlock, T.J.; Moyer, B.A. Oak Ridge National Lab., TN (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Conference on challenges and innovations in the management of hazardous waste; Washington, DC (United States); 10-12 May 1995. Order Number DE95014200. Source: OSTI; NTIS; INIS; GPO Dep.

Crown ethers dissolved in suitably modified aliphatic kerosene diluents can be employed to extract technetium as pertechnetate anion (TcO_4^-) with good extraction ratios from realistic simulants of radioactive alkaline nitrate waste. The modifiers utilized are non-halogenated and non-volatile, and the technetium can be removed from the solvent by stripping using water. The crown ethers bis-4,4′(5′)[(tert-butyl)cyclohexano]-18-crown-6 (di-t-BuCH18C6) and dicyclohexano-18-crown-6 (DCH18C6) provide stronger TcO_4^- extraction than dicyclohexano-21-crown-7 and 4-tert-butylcyclohexano 15-crown-5. Whereas DCH18C6 provides somewhat higher TcO_4^- extraction ratios than the more lipophilic di-t-BuCH18C6 derivative, the latter was selected for further study owing to its lower distribution to the aqueous phase. Particularly good extraction and stripping results were obtained with di-t-BuCH 18C6 at 0.02 M in a 2:1 vol/vol blend of tributyl phosphate and Isopar® M. Using this solvent, 98.9% of the technetium contained (at 6×10^{-5} M) in a Double-Shell Slurry Feed (DSSF) Hanford tank waste simulant was removed following two cross-current extraction contacts. Two cross-current stripping contacts with deionized water afforded removal of 99.1% of the technetium from the organic solvent.

23176 (CONF-9505217–2) **Using systems analysis to improve decision making in solving mixed waste problems at the Oak Ridge National Laboratory.** Ferrada, J.J.; Welch, T.D.;

Osborne-Lee, I.W.; Nehls, J.W. Jr. Oak Ridge National Lab., TN (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Air & Waste Management Association Policy meeting; Washington, DC (United States); 10-12 May 1995. Order Number DE95013201. Source: OSTI; NTIS; INIS; GPO Dep.

Systems analysis methods and tools have been developed and applied to the problem of selecting treatment technologies for mixed wastes. The approach, which is based on decision analysis, process modeling, and process simulation with a tool developed in-house, provides a one-of-a-kind resource for waste treatment alternatives evaluation and has played a key role in developing mandated treatment plans for Oak Ridge Reservation mixed waste.

23177 (CONF-9510125–1) **In situ techniques for the characterization and monitoring of a radioactively contaminated site for in situ vitrification.** Cline, S.R.; Bogle, M.A.; Spalding, B.P.; Naney, M.T. Oak Ridge National Lab., TN (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International symposium on environmental technologies: plasma systems and applications; Atlanta, GA (United States); 8-11 Oct 1995. Order Number DE95012896. Source: OSTI; NTIS; INIS; GPO Dep.

A treatability study was in October 1993 to evaluate the application of in situ vitrification (ISV) to an old seepage pit used for the disposal of radioactive liquid waste at the Oak Ridge National Laboratory (ORNL). This pit is one of seven inactive seepage pits and trenches at ORNL. During the 3 months that the pit was operated as a disposal facility, it is estimated to have received approximately 398 curies of mixed fission products, primarily ^{137}Cs, ^{90}Sr, and ^{106}Ru. Based on data from analysis of sludge from another pit, the activities for waste sludge in Pit 1 decay corrected to 1993 have been roughly estimated to be 71 and 17.5 curies of ^{137}Cs, and ^{90}Sr, respectively. The ^{106}Ru, with a half-life of 367 days, has decayed completely in the 42 years since its disposal in the pit Earthen fill material was added to the pit in 1981, and the pit area was then covered with an approximately 4–6 inch thick asphalt surface. Because so little information necessary for the effective and safe ISV of Pit 1 was available, the first phasm of the treatability study focused on site characterization activities. Several in-situ techniques were developed and used during characterization to ascertain the pit's lateral and vertical dimensions hydraulic and hydrologic properties, soil composition, contaminant inventory, and lateral and vertical distribution of radionuclides. At the end of the treatability study, this characterization effort will be evaluated to determine which properties were the most useful for designing and controlling the ISV process. Such information will be invaluable in efficiently and safely gathering characterization data for the remediation of the other seepage pits and trenilim at ORNL via ISV or alternative remediation techniques. This abstract briefly describes some of the major components of the field characterization activities and their results.

23178 (DOE/CAO–2056-Vol.1-Draft) **Draft Title 40 CFR 191 compliance certification application for the Waste Isolation Pilot Plant. Volume 1.** USDOE Carlsbad Area Office, NM (United States). 31 Mar 1995. 440p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE95012433. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Isolation Pilot Plant (WIPP) is a research and development facility for the demonstration of the permanent isolation of transuranic radioactive wastes in a geologic formation. The facility was constructed in southeastern New Mexico in a manner intended to meet criteria established by the scientific and regulatory community for the safe, long-term disposal of transuranic wastes. The US Department of Energy (DOE) is preparing an application to demonstrate compliance with the requirements outlined in Title 40, Part 191 of the Code of Federal Regulations (CFR) for the permanent disposal of transuranic wastes. As mandated by the Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act of 1992, the US Environmental Protection Agency (EPA) must evaluate this compliance application and provide a determination regarding compliance with the requirements within one year of receiving a complete application. Because the WIPP is a very complex program, the DOE has planned to submit the application as a draft in two parts. This strategy will allow for the DOE and the EPA to begin technical discussions on critical WIPP issues before the one-year compliance determination period begins. This report is the first of these two draft submittals.

23179 (DOE/CAO–2056-Vol.2-Draft) **Draft Title 40 CFR 191 compliance certification application for the Waste Isolation Pilot Plant. Volume 2: Appendices, AAC, BECR, BH.** USDOE Carlsbad Area Office, NM (United States); Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. 31 Mar 1995. 906p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE95012436. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the conceptual design of a system the Department of Energy (DOE) may implement for compliance with the requirement to control access to the disposal site. In addition, this report addresses the scheduling process for control of inspection, maintenance, and periodic reporting related to Long Term Monitoring which addresses the monitoring of disposal system performance, environmental monitoring in accordance with the Consultation and Cooperation Agreement between the DOE and the state of New Mexico, and evaluation of testing activities related to the Permanent Marker System design. In addition to access control addressed by this report, the controlling or cleaning up of releases from the site is addressed in the Conceptual Decontamination and Decommissioning Plan. The monitoring of parameters related to disposal system performance is addressed in the Long Term Monitoring Design Concept Description. Together, these three documents address the full range of active institutional controls planned after disposal of the TRU waste in the WIPP repository.

23180 (DOE/CAO–2056-Vol.3-Draft) **Draft Title 40 CFR 191 compliance certification application for the Waste Isolation Pilot Plant. Volume 3: Appendix BIR Volume 1.** USDOE Carlsbad Area Office, NM (United States); Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. 31 Mar 1995. 559p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-93AL96904 ; AC04-86AL31950. (CAO–94-1005-Rev.1). Order Number DE95012437. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Isolation Pilot Plant (WIPP) Transuranic Waste Baseline Inventory Report (WTWBIR) establishes a methodology for grouping wastes of similar physical and chemical properties, from across the US Department of Energy (DOE) transuranic (TRU) waste system, into a series of "waste profiles" that can be used as the basis for waste form discussions with regulatory agencies. The majority of this document reports TRU waste inventories of DOE defense sites. An appendix is included which provides estimates of commercial TRU waste from the West Valley Demonstration Project. The WIPP baseline inventory is estimated using waste streams identified by the DOE TRU waste generator/storage sites, supplemented by information from the Mixed Waste Inventory Report (MWIR) and the 1994 Integrated Data Base (IDB). The sites provided and/or authorized all information in the Waste Stream Profiles except the EPA (hazardous waste) codes for the mixed inventories. These codes were taken from the MWIR (if a WTWBIR mixed waste stream was not in MWIR, the sites were consulted). The IDB was used to generate the WIPP radionuclide inventory. Each waste stream is defined in a waste stream profile and has been assigned a waste matrix code (WMC) by the DOE TRU waste generator/storage site. Waste stream profiles with WMCs that have similar physical and chemical properties can be combined into a waste matrix code group (WMCG), which is then documented in a site-specific waste profile for each TRU waste generator/storage site that contains waste streams in that particular WMCG.

23181 (DOE/CAO–2056-Vol.4-Draft) **Draft Title 40 CFR 191 compliance certification application for the Waste Isolation Pilot Plant. Volume 4: Appendix BIR Volume 2.** USDOE Carlsbad Area Office, NM (United States); Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. 31 Mar 1995. 704p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CAO–94-1005-Rev.1). Order Number DE95012754. Source: OSTI; NTIS; INIS; GPO Dep.

This report consists of the waste stream profile for the WIPP transuranic waste baseline inventory at Lawrence Livermore National Laboratory. The following assumptions/modifications were made by the WTWBIR team in developing the LL waste stream profiles: since only current volumes were provided by LL, the final form volumes were assumed to be the same as the current volumes; the WTWBIR team had to assign identification numbers (IDs) to those LL waste streams not given an identifier by the site, the assigned identification numbers are consistent with the site reported numbers; LL Final Waste Form Groups were modified to be consistent with the nomenclature used in the WTWBID, these changes included word and spelling changes, the assigned Final Waste Form Groups are consistent with the information provided by LL; the volumes for the year 1993 were changed from an annual rate of generation (m^3/year) to a cumulative value (m^3).

23182 (DOE/EM–0238) **Cost Quality Management Assessment for the Oakland Operations Office. Final report.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Office of Engineering and Cost Management. Jun 1995. 114p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95013582. Source: OSTI; NTIS; INIS; GPO Dep.

The prime contractor of Lawrence Livermore National Laboratory (LLNL), University of California, is responsible for conducting environmental restoration (ER) and waste management (WM) activities at LLNL under the direction of the Oakland Operations Office (DOE-OAK). This report examines the overall DOE-OAK and LLNL process with respect to cost quality management for EM-30, EM-40, and EM-60 activities. The Round II Cost Quality Management Assessment (CQMA) conducted October 17–28, 1994, reviewed DOE-LAK's cost and cost-related management practices against Performance Objective and Criteria (POCs) contained in the CQMA Handbook (Rev. 3). Three subteams (Cost- and Schedule-Estimating Process, Independent Cost Review, and Management and Technical Evaluation) conducted interviews and reviewed documentation to assess cost and cost-related practices associated with EM-30, -40, and -60 activities. The detailed reports of the subteams are presented in section III. Included in the appendices are organizational charts of the Oakland Operations Office and Lawrence Livermore National Laboratory.

23183 (DOE/EM–0249) **Efficient Separations and Processing Crosscutting Program. Technology summary.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Jun 1995. 101p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016004. Source: OSTI; NTIS; INIS; GPO Dep.

The Efficient Separations and Processing (ESP) Crosscutting Program was created in 1991 to identify, develop, and perfect separations technologies and processes to treat wastes and address environmental problems throughout the DOE Complex. The ESP funds several multi-year tasks that address high-priority waste remediation problems involving high-level, low-level, transuranic, hazardous, and mixed (radioactive and hazardous) wastes. The ESP supports applied research and development (R and D) leading to demonstration or use of these separations technologies by other organizations within DOE-EM. Treating essentially all DOE defense wastes requires separation methods that concentrate the contaminants and/or purify waste streams for release to the environment or for downgrading to a waste form less difficult and expensive to dispose of. Initially, ESP R and D efforts focused on treatment of high-level waste (HLW) from underground storage tanks (USTs) because of the potential for large reductions in disposal costs and hazards. As further separations needs emerge and as waste management and environmental restoration priorities change, the program has evolved to encompass the breadth of waste management and environmental remediation problems.

23184 (DOE/MC/29249–4074) **Electromagnetic mixed-waste processing system for asbestos decontamination.** KAI Technologies, Inc., Woburn, MA (United States). Apr 1995. 136p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-94MC29249. Order Number DE95009720. Source: OSTI; NTIS; INIS; GPO Dep.

The first phase of a program to develop and demonstrate a cost-effective, integrated process for remediation of asbestos-containing material that is contaminated with organics, heavy metals, and radioactive compounds was successfully completed. Laboratory scale tests were performed to demonstrate initial process viability for asbestos conversion, organics removal, and radionuclide and heavy metal removal. All success criteria for the laboratory tests were met. (1) Ohio DSI demonstrated greater than 99% asbestos conversion to amorphous solids using their commercial process. (2) KAI demonstrated 90% removal of organics from the asbestos suspension. (3) Westinghouse STC achieved the required metals removal criteria on a laboratory scale (e.g., 92% removal of uranium from solution, resin loadings of 0.6 equivalents per liter, and greater than 50% regeneration of resin in a batch test.) Using the information gained in the laboratory tests, the process was reconfigured to provide the basis for the mixed waste remediation system. An integrated process is conceptually developed, and a Phase 2 program plan is proposed to provide the bench-scale development needed in order to refine the design basis for a pilot processing system.

23185 (DOE/RW/00134–T17) **Yucca Mountain Site Characterization Project technical data catalog quarterly supplement.** TRW, Inc., Fairfax, VA (United States). 31 Mar 1995. 179p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-91RW00134. Order Number DE95013073. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE)/Nuclear Regulatory Commission (NRC) Site-Specific Procedural Agreement for Geologic Repository Site Investigation and Characterization Program requires the DOE to develop and maintain a catalog of data which will be updated and provided to the NRC at least quarterly. This catalog is to include a description of the data; the time (date), place, and method of acquisition; and where the data may be examined. The Yucca Mountain Site Characterization Project (YMP) Technical Data Catalog is published and distributed in accordance with t requirements of the Site-Specific Agreement. The YMP Technical Data Catalog is a report based on reference information contained in the YMP Automated Technical Data Tracking System (ATDT). The reference information is provided by Participants for data acquired or developed in support of the YMP. The Technical Data Catalog is updated quarterly and distributed in the month following the end of each quarter. A complete revision to the catalog is published at the end of each fiscal year. Supplements to the end-of-year edition are published each quarter. These supplements provide information related to new data items not included in previous quarterly updates and data items affected by changes to@ previously published reference information. The Technical Data Catalog, dated September 30, 1994, should be retained as the baseline document for the supplements until the end-of-year revision is published and distributed in October 1995.

23186 (DOE/RW/00134–T19) **Technical Data Catalog: Yucca Mountain Site Characterization Project. Quarterly supplement.** USDOE Yucca Mountain Site Characterization Project Office, Las Vegas, NV (United States). 30 Jun 1995. 172p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-91RW00134. Order Number DE95015529. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents reference information contained in the Yucca Mountain Project Automated Technical Data Tracking System. The Department of Energy is seeking to design and maintain a geologic repository for the disposal of high-level radioactive wastes. However, before this repository can be built, the DOE must first do a comprehensive site evaluation. This evaluation is subject to many regulations. This report fulfills the reporting requirements of the Site-Specific Procedural Agreement for Geologic Repository to develop and maintain a catalog of data which will be updated and provided to the Nuclear Regulatory Commission on a quarterly basis. This catalog contains: description of data; time, place, and method of acquisition; and where data may be examined.

23187 (DOE/RW–0464) **Office of Civilian Radioactive Waste Management Fiscal Year 1994 annual report to Congress.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). May 1995. 110p. Sponsored by

USDOE, Washington, DC (United States). Order Number DE95013657. Source: OSTI; NTIS; INIS; GPO Dep.

The events of Fiscal Year 1994 made it a notable year in OCRWN's history. Highlights include formulation of a new program approach; intensive consultation with other parties to build confidence in that approach; the delivery, assembly, and initial testing of the tunnel boring machine that is now digging into Yucca Mountain; steps toward acquisition of a standardized multipurpose canister system and planning for the accompanying environmental impact statement; and solicitation, through a Federal Register notice, of utilities' and other interested parties' recommendations toward resolving key waste-acceptance issues.

23188 (DOE/WIPP–94-011) **Brine Sampling and Evaluation Program 1992–1993 report and summary of BSEP data since 1982.** Deal, D.E. (I. T. Corp., Carlsbad, NM (United States)); Abitz, R.J.; Belski, D.S. USDOE Albuquerque Operations Office, Carlsbad, NM (United States). Waste Isolation Pilot Plant Project Office. Apr 1995. 293p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE95016694. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the last one that is currently scheduled in the sequence of reports of new data, and therefore, also includes summary comments referencing important data obtained by BSEP since 1983. These BSEP activities document and investigate the origins, hydraulic characteristics, extent, and composition of brine occurrences in the Permian Salado Formation and seepage of that brine into the excavations at the (WIPP) Waste Isolation Pilot Plant. A project concern is that enough brine might be present after sealing and closure to generate large quantities of hydrogen gas by corroding the metal in the waste drums and waste inventory. This report describes progress made during the calendar years 1992 and 1993 and focuses on four major areas: (1) monitoring of brine inflow, e.g., measuring brines recovered from holes drilled downward from the underground drifts (downholes), upward from the underground drifts (upholes), and from subhorizontal holes from the underground drifts; (2) observations of weeps in the Air Intake Shaft (AIS); (3) further characterization of brine geochemistry; and (4) additional characterization of the hydrologic conditions in the fractured zone beneath the excavations.

23189 (EML–567) **Inventory of site-derived ^{36}Cl in the Snake River plain aquifer, Idaho National Engineering Laboratory, Idaho.** Beasley, T.M. Department of Energy, New York, NY (United States). Environmental Measurements Lab. Feb 1995. 51p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014966. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive waste management practices at the U.S. Department of Energy's Idaho National Engineering Laboratory (INEL) in Idaho have introduced ^{36}Cl ($T_{1/2}$ = 301,000 yr) into the Snake River Plain aquifer underlying the site. The ^{36}Cl is believed to originate from neutron activation of stable ^{35}Cl in nuclear fuels (principally) and in reactor cooling/process water. Wastewater releases of ^{3}H at the INEL have been documented by the site operators for the period 1952 to 1988. During this time, approximately 1.2 PBq of ^{3}H (30,000 Ci) were introduced to the subsurface through disposal wells and seepage ponds. By sampling a number of monitoring and production wells downgradient from points of introduction, ^{3}H movement and dispersion in the groundwater have been documented by the U.S. Geological Survey. The present report uses these historical ^{3}H release and monitoring data to choose hydrologic parameters (matrix porosity and plume penetration depth) that produce concordance between the ^{3}H release estimates and the inventory calculated from measurements of ^{3}H in the subsurface. These parameters are then applied to ^{36}Cl isopleths to generate an estimated ^{36}Cl inventory in the subsurface. Using assumptions about irradiation times, neutron fluxes, and total fuel processed, as little as 23 g of stable chloride impurity in fuel elements would be adequate to produce the amount of ^{36}Cl estimated to be in the groundwaters underlying the site. The highest atom concentration of ^{36}Cl measured onsite (222×10^{10} atoms l^{-1}) corresponds to an activity level of ~4 pCi l^{-1} and represents 0.2 percent of the U.S. Environmental Protection Agency's (EPA) drinking water standard for this radionuclide (2000 pCi l^{-1}).

23190 (ENRESA–03/95) **Thermo-hydro-mechanical characterization of the Spanish reference clay material for engineered barrier for granite and clay MLW repository: laboratory and small mock up testing.** Villar, M.V. No corporate text available. 1995. 120p. Order Number DE95789657. Source: OSTI; NTIS; INIS.

This report refers to the work carried out by Technic Geologic Division of CIEMAT (CIEMAT.DT.TG) coordinated by SCK/CEN (Belgium), participating besides UPC-DIT and University of Wales on the framework of CEC Contract F12W-CT91-0102 (DOEO). It presents the results obtained. The total results on the project will be published by CE in the EUR series. The role of CIEMAT in this project was to carry out tests in which the conditions of the clay barrier in the repository were simulated. The interaction of heat coming from the wastes and of water coming from the geological medium has been reproduced on compacted clay blocks. For the performance of tests on high density compacted clay blocks (Task 2.1) and for the cementation and chemical-mineralogical transformation studies two different cells were designed and constructed in stainless steel: a thermohydraulic cell and an alteration cell. The experiments performed in these cells have provided us with a better knowledge of the heat source, hydration system and sensors, as well as interesting data on heat and water diffusion. A revision of the experiments performed on the thermohydraulic cell was presented at the "International Workshop on Thermomechanics of Clays and Clay Barriers" held in Bergamo in October'93 (Villar et al. 1993).

23191 (ENRESA–04/95) **Synthesis report of geotechnic assessment to clay-AGP design: reference concept.** Fária, P.; Pedraza, L.; Ruiz, F. No corporate text available. 1995. 60p. (In Spanish). Order Number DE95789656. Source: OSTI; NTIS; INIS.

This report summarizes the studies on clays for the storage of radioactive wastes. The study is focussed to the geotechnical assessment for the clays. The report presents the methodology analysis, the geotechnical feasibility, minimizing methods, costs and operation.

23192 (ES/WM–30) **Oak Ridge Reservation Waste Management Plan.** Turner, J.W. (ed.). Oak Ridge National Lab., TN (United States). Feb 1995. 247p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M–4090). Order Number DE95012970. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the waste management plan for the Oak Ridge Reservation facilities. The primary purpose is to convey what facilities are being used to manage wastes, what forces are acting to change current waste management systems, and what plans are in store for the coming fiscal year.

23193 (JAERI-Review–95-009) **Methodologies for measurement and application of distribution coefficient.** Uchida, Shigeo (National Inst. of Radiological Sciences, Hitachinaka, Ibaraki (Japan). Nakaminato Lab. Branch); Yasuda, Hiroshi; Mahara, Yasunori; Sasaki, Noriyuki; Takahashi, Tomoyuki; Kimura, Hideo; Matsuzuru, Hideo. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1995. 72p. (In Japanese). Order Number DE95789395. Source: OSTI; NTIS; INIS.

The distribution coefficient, as an equilibrium parameter, which defines partitioning of a solute between a solid and liquid phase, is commonly used in safety assessment of nuclear waste disposal ; e.q., in (1) analysis of the release behavior of radionuclides from a repository (a source term analysis), (2) analysis of the migration behavior of radionuclides in the geosphere, and (3) analysis of the transport behavior of radionuclides in the biosphere. Since the distribution coefficient is utilized in analyses of essential components involved in a nuclear waste disposal system as mentioned above, one of important requirements is appropriate measurement and application of the distribution coefficient, particularly to ensure a credibility of safety assessment. Aiming at the recommendation of a standard methodology through studies on the methodologies for measurement and application of the distribution coefficient, the following issues are being discussed by 'WG on Parameters for Safety Assessment' of 'Technical Committee on Behavior of Environmental Radioactivity' which belongs to 'Research Committee on Environmental Radioactivity' organized by Japan Atomic Energy

Research Institute; Transport of radionuclides in environment, Theoretical aspects of the distribution coefficient, Application of the coefficient in safety assessment, State-of-the-art of methodologies to measure the coefficient, Review of the coefficient. The report entitled 'Methodologies for Measurement and Application of the Distribution Coefficient' summarizes the achievements of the WG in 1994, which were subject to a technical review by both the Research Committee on Environmental Radioactivity and the Technical Committee on Behavior of Environmental Radioactivity. (author).

23194 (KFK–5351) **Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).** Pfeifer, W. (comp.). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The twelve seminar papers compiled in the KfK report deal with the current state of the art and the technology available in Germany for the management of radioactive liquid and solid wastes, and radioactive scrap. Some papers discuss particular technical aspects of techniques such as solidification, volume reduction, and compaction. The function of the Waste Collecting Centres of the Laender is explained. (HP)

23195 (KFK–5351, pp. 1.1-1.13) **Management of radioactive remnants at HDB facility of KfK - a survey.** Pfeifer, W. (Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The paper mentions the nuclear facilities delivering their radwaste to the decontamination facility, HDB, of KfK. A major task of HDB is the treatment of radioactive remnants and wastes from nuclear installations outside the Karlsruhe Nuclear Research Center. HDB is equipped with the complete set of systems required for the treatment and conditioning of radwaste, the main activity being the treatment of radioactive remnants for their restricted or unrestricted reuse beyond the applicability of the Atomic Energy Act. Treatment of other radwaste primarily aims at waste volume reduction. The paper outlines the scope of activities of HDB as determined by a medium-termed planning frame, providing for an extension of capacities and equipment for the treatment of non-burnable, solid wastes in order to cope with the radioactive scrap expected in the years to come as a result of shutdown and decommissioning of nuclear installations based at KfK. (orig./HP)

23196 (KFK–5351, pp. 10.1-10.14) **Thirty years of experience with the decontamination of equipment.** Hempelmann, W. (Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The paper summarizes the history of equipment decontamination from the 1960s to date, explaining the tasks and purposes of decontamination techniques, personnel placement, and results achieved. The defined decontamination task in the beginning was to clean contaminated equipment primarily sent from KfK installations for the purpose of unrestricted reuse, by means of wet chemical methods. This task eventually was widened to cover decontamination of radioactive remnants for unrestricted recycling. The techniques applied today include dry peening with steel gravel for decontamination of C-steel, lead, or concrete objects, and pickling for decontamination of austenitic steels and non-ferrous metals. Remnants not suitable for decontamination are processed in a facility available since 1984 to form compacted waste forms suitable for ultimate disposal. There are new tasks ahead for the Decontamination Dept. emanating from future reactor decommissioning and shutdown of other nuclear installations, as e.g. the WAK. (orig.)

23197 (KFK–5351, pp. 11.1-11.12) **Melting of radioactive metals from nuclear installations. History and stages of development.** Sappok, M. (Siempelkamp Giesserei GmbH und Co., Krefeld (Germany)). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

When it became clear in 1989 that the amounts of radioactive material to be treated in future will reach a volume suggesting melting as an alternative method, the decision was taken to build a single-purpose plant exclusively for melting radioactive metal wastes. The CARLA facility was erected and commissioned within only six months, and to date has been processing more than 5 000 tons of material, so that specific experience and operating data have been accumulated relating to a throughput of about 7 000 tons. (orig.)

23198 (KFK–5351, pp. 12.1-12.20) **Emissions induced by the process of radioactive remnants conditioning.** Becker, R. (Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The techniques applied in the Decontamination Dept., HDB, for conditioning radioactive primary and secondary waste induce emission of radiological and chemical pollutants. The paper explains the current common practice of emission monitoring and presents data of the plant-specific release of pollutants via the gaseous and liquid effluents pathway. Practice has shown that there have been no problems at all in keeping the emissions from operation below the regulatory maximum acceptable limits. The amounts released are so small that the effects on the environment remain at minimum level. Thus pollutant emission is not a factor restricting the processing of radioactive remnants or primary waste, even if high-level radioactive inventories are involved, if conditioning systems are designed and constructed in line with the appropriate operating data accumulated so far, and if emssion control is made a prime goal in the planning, control and monitoring of procedures and processes. (orig.)

23199 (KFK–5351, pp. 2.1-2.11) **Waste management tasks of the Radwaste Collecting Centers of the Laender.** Dreisvogt, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The paper outlines the manifold activities of the Radwaste Collecting Centers of the Laender. According to section 9 a, sub-sec. 3 of the Atomic Energy Act, the various Laender in Germany are obliged to establish such centers whose purpose among other things is to serve as interim storage site for radwaste accrued at medical, industrial, or research facilities. (HP)

23200 (KFK–5351, pp. 3.1-3.17) **Looking back on 30 years of experience in the decontamination of radioactive, liquid effluents at KfK. The vapour compression evaporator, for example.** Pfeiffer, R. (Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The first equipment installed at KfK-HDB was a system with a thin-film evaporator. This was later replaced by two vapor compression evaporating units with forced circulation, for evaporation of liquid LAW, and a steam-heated natural circulation evaporator, for evaporation of liquid MAW. Nuclear activities of the Karlsruhe Nuclear Research Center phasing out, the liquid radwaste quantities to be treated have been shrinking accordingly, so that the current system is planned to be replaced by a smaller system with a thin-film evaporator. (orig./HP)

23201 (KFK–5351, pp. 4.1-4.24) **Treatment of radioactive remnants. Solidification of evaporation concentrates by vacuum distillation.** Engelage (Gesellschaft fuer Nuklearservice, Essen (Germany)). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The paper deals with the treatment of liquid, inorganic remnants, i.e. evaporator concentrates, focussing on the technique of achieving solidification by dehydration. After a brief general survey of systems installed and techniques applied in Germany, two systems, named Robe and FAVORIT, are explained in more detail. Their performance and design data are discussed, and the history of the FAVORIT system is presented, showing the development of this system and its upgrading in response to changing conditions in the waste management field. (orig.)

23202 (KFK–5351, pp. 5.1-5.15) **Solidification of evaporator concentrates by means of cementation.** Vogt, L. (Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The paper recapitulates the history of development of techniques applied in the HDB department of KfK for the solidification of evaporator concentrates by way of cementation. The currently installed system is explained in design and operation. The accumulation, analysis and conditioning of concentrates according to the Conditioning Handbook is set out, as well as the determination of cementation-specific data for operational and product optimization. Novel techniques for concentrate solidification are also addressed, which are primarily aiming at waste volume minimization. (orig.)

23203 (KFK–5351, pp. 6.1-6.12) **The current technical level and planned development of waste burning plants installed at HDB.** Dirks, F. (Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The HDB department has been operating plants for burning radioactive remnants since 1972. The department is responsible for management of the radioactive waste accrued at KfK institutes, Baden-Wuerttemberg's Radwaste Collection Center, and, if plant capacity allows, delivered from other Laender on a contractual basis. The paper explains the origin and composition of the remnants to be treated, the treatment techniques available at HDB, and the capacities of the plants installed. Their current technical level is described as well as the upgrading to be achieved by December 1996 in order to meet the requirements set by the Clean Air Technical Code (TA Luft) and the 17th Ordinance For Emission Control (BImSchV). (orig.)

23204 (KFK–5351, pp. 7.1-7.15) **Dehydration in the hot-gas filtering unit as a means of reducing the volume of secondary waste from the waste burning process.** Chrubasik, A. (Nukem, Alzenau (Germany)); Bruenner, G. Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The flue gas generated in the incineration of radioactive wastes is treated by flue gas scrubbing for pollutant removal. The heat available in the incineration plant is used for dehydration of the washing fluid, and the resulting salt is compacted and processed into waste forms suitable for ultimate disposal. The final waste volume thus is only one sixth of the volume that would be produced by cementation. The hot-gas filtering unit of the incineration plant has been chosen as best suitable process unit for dehydration, as it offers the heat required for evaporation and at the same time allows deposition of the salt aerosols at the filter tubes. (orig./HP)

23205 (KFK–5351, pp. 8.1-8.11) **Ten years of experience with the operation of the LAW scrap processing plant.** Suchowitz, M. (Kraftanlagen AG Heidelberg (Germany)). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The paper describes the LAW scrap processing plant in technical design and performance and presents operating data such as personnel requirements, plant availability, average reduction factor, and resulting collective doses. The plant's throughput is broken down into volumina, number of compacted waste forms, number of 200 litre waste drums. (orig./HP)

23206 (KFK–5351, pp. 9.1-9.16) **The new MAW scrap processing facility.** Kueppers, L. (Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe). Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Dekontaminationsbetriebe. May 1994. 183p. (In German). (CONF-9308272–: Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK), Karlsruhe (Germany), 26 Aug 1993). In *Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB).* Order Number DE95796284. Source: OSTI; NTIS (US Sales Only); INIS.

The shielded bunker for heat-generating waste attached to the MAW scrap processing cell will be modified and extended to comprise several MAW scrap processing cells of enhanced throughput capacity, and a new building to serve as an airlock and port for acceptance of large shipping casks (shipping cask airlock, TBS). The new facility is to process scrap from decommissioned nuclear installations, and in addition radwaste accrued at operating plants of utilities. This will allow efficient and steady use of the new MAW

scrap processing facility. The planning activities for modification and extension are based on close coordination between KfK and the GNS mbH, in order to put structural dimensioning and capacity planning on a realistic basis in line with expected amounts of radwaste from operating nuclear installations of utilities. The paper indicates the currently available waste amount assessments covering solid radwaste (MAW) from the decommissioning of the WAK, MZFR, and KNK II, and existing waste amounts consisting of core internals of German nuclear power plant. The figures show that the MAW scrap processing facility will have to process an overall bulk of about 1100 Mg of solid waste over the next ten years to come. (orig./HP)

23207 (LA–12824-MS) **Selection of a preferred initial access for the exploratory studies facility.** Boak, D.M. (Woodward Clyde Federal Services, Las Vegas, NV (United States)); Cikanek, E.M.; Elkins, N.Z. Los Alamos National Lab., NM (United States). Jun 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015063. Source: OSTI; NTIS; INIS; GPO Dep.

An issue of interest to the Yucca Mountain Site Characterization Project Office (YMPO) has been selection of the preferred location for initial access to the Exploratory Studies Facility (ESF) in the event that the U.S. Department of Energy (DOE) elected to proceed with a phased approach to facility development. A task force to conduct an assessment and prepare a recommendation of the preferred initial location (north or south) for starting underground in situ tests at Yucca Mountain was initiated by YMPO to address this issue. The task force addressed geotechnical issues associated with the presence of disqualifying conditions at the site, the inability of the site to meet qualifying conditions, and the potential for unexpected geologic conditions at the site. The task force compared the north and south ramp accesses of the ESF to determine whether either access would be more likely to provide relevant information about potential site unsuitability. The task force did not address issues such as design time or construction costs. Within the aforementioned context, a balanced evaluation of currently available geotechnical information and issues failed to provide a clear mandate for either ramp as the preferred initial ESF access. Neither access was clearly superior in providing geotechnical information to resolve site suitability issues. The task force therefore recommended that other appropriate programmatic factors, such as schedule, be used as a basis in determining the choice of a preferred, initial ESF access in the event of phased construction.

23208 (LA–12954-MS) **Radionuclide concentrations in vegetation at radioactive-waste disposal Area G during the 1994 growing season.** Fresquez, P.R.; Biggs, J.B.; Bennett, K.D. Los Alamos National Lab., NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015051. Source: OSTI; NTIS; INIS; GPO Dep.

Overstory (pinon pine) and understory (grass and forb) vegetation samples were collected within and around selected points at Area G-a low-level radioactive solid-waste disposal facility at Los Alamos National Laboratory-for the analysis of tritium (^{3}H), strontium (^{90}Sr), plutonium (^{238}Pu and ^{239}Pu), cesium (^{137}Cs), americium (^{241}Am), and total uranium. In general, most vegetation samples collected within and around Area G contained radionuclide levels in higher concentrations than vegetation collected from background areas. Tritium, in particular, was detected as high as 5,800 pCi/mL in overstory vegetation collected outside the fence just west of the tritium shafts; this suggests that tritium is migrating from this waste repository through subsurface pathways. Also, understory vegetation collected north of the transuranic (TRU) pads (outside the fence of Area G) contained the highest values of ^{90}Sr, ^{238}Pu, ^{239}Pu, ^{137}Cs, and ^{241}Am, and may be a result of surface holding, storage, or disposal activities.

23209 (LA-SUB–95-36-Vol.2) **FY94 CAG trip reports, CAG memos and other products: Volume 2. Final report.** Los Alamos National Lab., NM (United States); Computer Applications Group, Inc., Carlton, OR (United States). 15 Dec 1994. 290p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95013477. Source: OSTI; NTIS; INIS; GPO Dep.

The Yucca Mountain Site Characterization Project (YMP) of the US DOE is tasked with designing, constructing, and operating an Exploratory Studies Facility (ESF) at Yucca Mountain, Nevada. The purpose of the YMP is to provide detailed characterization of the Yucca Mountain site for the potential mined geologic repository for permanent disposal of high-level radioactive waste. Detailed characterization of properties of the site are to be conducted through a wide variety of short-term and long-term in-situ tests. Testing methods require the installation of a large number of test instruments and sensors with a variety of functions. These instruments produce analog and digital data that must be collected, processed, stored, and evaluated in an attempt to predict performance of the repository. The Integrated Data and Control System (IDCS) is envisioned as a distributed data acquisition that electronically acquires and stores data from these test instruments. IDCS designers are responsible for designing and overseeing the procurement of the system, IDCS Operation and Maintenance operates and maintains the installed system, and the IDCS Data Manager is responsible for distribution of IDCS data to participants. This report is a compilation of trip reports, interoffice memos, and other memos relevant to Computer Applications Group, Inc., work on this project.

23210 (LA-SUB–95-73) **Determination of water movement in the unsaturated zone at Yucca Mountain using chloride, bromide, and chlorine isotopes as environmental tracers. Final report.** Los Alamos National Lab., NM (United States); Hydro Geo Chem., Inc., Tucson, AZ (United States). 31 Jul 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95014568. Source: OSTI; NTIS; INIS; GPO Dep.

This report, prepared by Hydro Geo Chem staff for Los Alamos National Laboratory, summarizes work conducted by the company under Subcontract 9-XG1-N3993-1. The ultimate objective of this work is to characterize the movement of subsurface water in the vicinity of Yucca Mountain, Nevada. Data produced under this contract is to be used by the US Department of Energy in its Yucca Mountain Site Characterization Project (YMP) to help determine hydrologic flows that may affect the performance of a potential nuclear waste repository. The data may be used in the licensing proceedings, and certain quality assurance procedures have thus been required. The work has focussed on measuring the distribution of environmental tracers-chlorine-36, chlorine, and bromine-and on evaluating the depth to which these conservative solutes have percolated in the unsaturated zone at Yucca Mountain. The following discussion summarizes progress made on the tasks outlined in the original Scope of Work. Details of this work and all data acquired by Hydro Geo Chem for this subcontract have been systematically organized in logbooks and laboratory notebooks. These documents have been structured to make it easy to trace the analytical history of a sample, from time of receipt to the final analytical results.

23211 (LA-UR–95-1838) **Mixed waste focus area alternative technologies workshop.** Borduin, L.C. (Los Alamos National Lab., NM (United States). Technology Analysis Group); Palmer, B.A.; Pendergrass, J.A. Los Alamos National Lab., NM (United States). 24 May 1995. 158p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9501100–Summ: Mixed waste focus area alternative technologies workshop, Salt Lake City, UT (United States), 24-27 Jan 1995). Order Number DE95015256. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the Mixed Waste Focus Area (MWFA)-sponsored Alternative Technology Workshop held in Salt Lake City, Utah, from January 24–27, 1995. The primary workshop goal was identifying potential applications for emerging technologies within the Options Analysis Team (OAT) "wise" configuration. Consistent with the scope of the OAT analysis, the review was limited to the Mixed Low-Level Waste (MLLW) fraction of DOE's mixed waste inventory. The Los Alamos team prepared workshop materials (databases and compilations) to be used as bases for participant review and recommendations. These materials derived from the Mixed Waste Inventory Report (MWIR) data base (May 1994), the Draft Site Treatment Plan (DSTP) data base, and the OAT treatment facility configuration of December 7, 1994. In reviewing workshop results, the reader should note several caveats regarding data limitations. Link-up of the MWIR and DSTP data bases, while

representing the most comprehensive array of mixed waste information available at the time of the workshop, requires additional data to completely characterize all waste streams. A number of changes in waste identification (new and redefined streams) occurred during the interval from compilation of the data base to compilation of the DSTP data base with the end result that precise identification of radiological and contaminant characteristics was not possible for these streams. To a degree, these shortcomings compromise the workshop results; however, the preponderance of waste data was linked adequately, and therefore, these analyses should provide useful insight into potential applications of alternative technologies to DOE MLLW treatment facilities.

23212 (LBL–37040) **A simple procedure for estimating the effective hydraulic conductivity of a two-dimensional saturated or partly-saturated fracture network.** Zimmerman, R.W.; Bodvarsson, G.S. Lawrence Berkeley Lab., CA (United States). Apr 1995. 10p. Sponsored by USDOE, Washington, DC (United States);Geological Survey, Reston, VA (United States). DOE Contract AC03-76SF00098. (CONF-9504179–1: 6. annual international conference on high level radioactive waste management, Las Vegas, NV (United States), 30 Apr - 5 may 1995). Order Number DE95014872. Source: OSTI; NTIS; INIS; GPO Dep.

Many of the sites that have been proposed as potential locations of underground radioactive waste respositories contain fractured rocks. When modeling the hydrological behavior of these sites, for either the purpose of site characterization or performance assessment, computational gridblocks are often used that contain large numbers of individual fractures. In order to treat these gridblocks as equivalent continua, it is necessary to develop a procedure for relating the hydraulic properties of the individual fractures, and the topology of the fracture network, to the overall gridblock-scale permeability. The purpose of this paper is to describe a simple upscaling procedure, and demonstrate its use in cases of both saturated and unsaturated flow. The effective medium theory developed by Kirkpatrick has been used as the basis for a procedure for finding the effective gridblock-scale conductivity of a two-dimensional fracture network. In contrast to computationally-intensive flow simulations, the proposed procedure requires only the solution of a single nonlinear equation. The method has been tested against some previously published numerical simulations of flow through saturated and unsaturated networks, and in both cases yields reasonably accurate predictions of the macroscopic hydraulic conductivity.

23213 (LBL–37332) **Effective transmissivity of two-dimensional fracture networks.** Simmerman, R.W.; Bodvarsson, G.S. Lawrence Berkeley Lab., CA (United States). Apr 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95015139. Source: OSTI; NTIS; INIS; GPO Dep.

Many of the sites that have been proposed as potential locations of underground radioactive waste repositories contain fractured rocks. For example, both the saturated and unsaturated zone at Yucca Mountain, Nevada, contains many hydrogeologic units that are extensively fractured. When modeling the hydrological behavior of these sites, for either the purpose of site characterization of performance assessment, computational grid-blocks are often used that contain large number of fractures. In order to treat these as equivalent continua, it is necessary to develop a procedure for relating the hydraulic properties of the individual fractures and he topology of the fracture network to the overall scale permeability. One aspect of this problem is that of determining the in situ hydraulic properties of the individual fractures. Another aspect is to reconstruct the three-dimensional geometry of the fracture network based on borehole or outcrop measurements. The final stage in the problem is that of taking a network of known geometry and determining it effective scale conductivity. The purpose of this paper is to describe a simple procedure for solving this latter problem,a nd to demonstrate it use in cases of both saturated and unsaturated flow. The TOUGH simulator was used.

23214 (LBL–37337) **Weathering products of basic rocks as sorptive materials of natural radionuclides.** Omelianenko, B.I. (AN SSSR, Moscow (Russian Federation). Inst. Geologii Rudnykh Mestorozhdenij, Petrografii, Mineralogii i Geokhimii); Niconov, B.S.; Ryzhov, B.I.; Shikina, N.D. Lawrence Berkeley Lab., CA (United States). Jun 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95015137. Source: OSTI; NTIS; INIS; GPO Dep.

The principal requirements for employing natural minerals as buffer and backfill material in high-level waste (HLW) repositories are high sorptive properties, low water permeability, relatively high thermal conductivity, and thermostability. The major task of the buffer is to prevent the penetration of radionuclides into groundwater. The authors of this report examined weathered basic rocks from three regions of Russia in consideration as a suitable radioactive waste barrier.

23215 (NCRP–95-22246) **Radioactive and mixed waste - risk as a basis for waste classification. Symposium proceedings No. 2.** Oak Ridge National Lab., TN (United States). 21 Jun 1995. 201p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-941192–: Symposium on radioactive and mixed waste: risk as a basis for waste classification, Las Vegas, NV (United States), 9 Nov 1994). Order Number DE95016101. Source: OSTI; NTIS; INIS; NCRP Publications, 7910 Woodmont Avenue, Suite 800, Bethesda, MD 20814-3095; GPO Dep.

The management of risks from radioactive and chemical materials has been a major environmental concern in the United states for the past two or three decades. Risk management of these materials encompasses the remediation of past disposal practices as well as development of appropriate strategies and controls for current and future operations. This symposium is concerned primarily with low-level radioactive wastes and mixed wastes. Individual reports were processed separately for the Department of Energy databases.

23216 (ORNL/ER–294) **Readiness review plan for the in situ vitrification demonstration of Seepage Pit 1 in Waste Area Grouping 7.** Oak Ridge National Lab., TN (United States). May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014002. Source: OSTI; NTIS; INIS; GPO Dep.

A treatability study is planned that encompasses the application of in situ vitrification (ISV) to at least two segments of the Oak Ridge National Laboratory Seepage Pit I during the third quarter of fiscal year 1995. Before the treatability study can be initiated, the proposed activity must be subjected to an Operational Readiness Review (ORR). ORR is a structured methodology of determining readiness to proceed as outlined in Martin Marietta Energy Systems, Inc. (Energy Systems), Environmental Restoration Waste Management Procedure ER/C-P1610, which provides Energy Systems organizations assurance that the work to be performed is consistent with management's expectations and that the subject activity is ready to proceed safely. The readiness review plan provides details of the review plan overview and the scope of work to be performed. The plan also identifies individuals and position responsibilities for implementing the activity. The management appointed Readiness Review Board (RRB) has been identified. A Field Readiness Review Team (FRT), a management appointed multidisciplinary group, has been established (1) to evaluate the ISV treatability study, (2) to identify and assemble supporting objective evidences of the readiness to proceed, and (3) to assist the team leader in presenting the evidences to the RRB. A major component of RRB is the formulation of readiness review criteria months before the operation. A comprehensive readiness review tree (a positive logic tree) is included, which identifies the activities required for the development of the readiness criteria. The readiness review tree serves as a tool to prevent the omission of an item that could affect system performance. All deficiencies identified in the review will be determined as prestart findings and must be resolved before the project is permitted to proceed. The final approval of the readiness to proceed will be the decision of RRB.

23217 (ORNL/TM–12784) **Application of the TRUEX process to highly irradiated targets.** Felker, L.K.; Benker, D.E. Oak Ridge National Lab., TN (United States). Mar 1995. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011630. Source: OSTI; NTIS; INIS; GPO Dep.

The Radiochemical Engineering Development Center (REDC) at Oak Ridge National Laboratory processes highly irradiated targets for the Mark 42 program to separate americium, curium, and plutonium. Argonne National Laboratory (ANL) has developed the TRUEX process for the removal of transuranic elements from aqueous waste streams and a computer model that aids in the design of potential flowsheets. Because the TRUEX process is attractive for application to the large volumes of high-activity tank wastes stored at various Department of Energy sites, a test of the process on the highly irradiated Mark 42 target material would yield useful information on the performance of the process under "real" conditions. Researchers at ANL used the Generic TRUEX Model (GTM) to design a TRUEX flowsheet to process Mark 42 target material. Researchers at the REDC refurbished the Solvent Extraction Test Facility mixer-settler contactors and conducted three test runs using the TRUEX process. The results from the three demonstration tests are presented along with the predicted results from the GTM.

23218 (ORNL/TM–12913) **Liquid and Gaseous Waste Operations Department annual operating report CY 1994.** Maddox, J.J.; Scott, C.B. Oak Ridge National Lab., TN (United States). Mar 1995. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014460. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents details about the operation of the liquid and gaseous waste department of Oak Ridge National Laboratory for the calendar year 1994. Topics discussed include; process waste system, upgrade activities, low-level liquid radioactive waste solidification project, maintenance activities, and other activities such as training, audits, and tours.

23219 (ORNL/TM–12919) **Environmental assessment and social justice.** Vogt, B.M. (Oak Ridge National Lab., TN (United States)); Sorensen, J.H.; Hardee, H. Oak Ridge National Lab., TN (United States). Mar 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012501. Source: OSTI; NTIS; GPO Dep.

The purpose of this document is to describe an approach to assessing environmental justice issues at the start of proposed project. It is a structural approach to screening using readily available census data and commercial products that emphasizes the ability to replicate results and provide systematic data that can be used to identify spatial inequities. While our discussion of the methodology addresses only public health and safety issues related to certain minority and cohort sub-groups, systematic use of methodology could provide a valuable screening tool for identifying impacts particular to low-income groups. While the assumptions can be questioned as to applicability, they are based both on theory and practical knowledge.

23220 (ORNL/TM–12935) **Tank Focus Area Pretreatment Program. FY 1995 Program Management Plan.** Morrison, M.I. (Midwest Technical Inc., Oak Ridge, Tennessee (United States)); McGinnis, C.P.; Wilkenson, W.T.; Hunt, R.D. Oak Ridge National Lab., TN (United States). Feb 1995. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012546. Source: OSTI; NTIS; INIS; GPO Dep.

This program management plan (PMP) describes the FY 1995 project plans for the Pretreatment Program of the Tank Focus Area. The Tank Focus Area is one of five areas of environmental concerns originally identified by the Deputy Assistant Secretary for Technology Development (EM-50). Projects in the Tank Focus Area relate to the remediation of liquid waste stored in underground storage tanks at various US Department of Energy sites. The Pretreatment Program is an organizational unit performing work within the Tank Focus Area. The function of the Pretreatment Program is to develop, test, evaluate, and demonstrate new technologies, with emphasis on separations. The 11 Pretreatment Program projects for FY 1995 are (1) Cesium Extraction Testing, (2) Comprehensive Supernate Treatment, (3) Hot Cell Studies, (4) Cesium Removal Demonstration, (5) Out-of-Tank Evaporator Demonstration, (6) Crossflow Filtration, (7) Technical Interchange with CEA, (8) TRUEX Applications, (9) NAC/NAG Process Studies (conducted at Oak Ridge National Laboratory), (10) NAC/NAG Process and Waste Form Studies (conducted at Florida International University), and (11) Program Management. Section 2 of this PMP contains a separate subsection for each FY 1995 project. A brief description of the project, a schedule of major milestones, and a breakdown of costs are provided for each project. The PMP also contains sections that describe the project controls that are in place. Quality assurance, document control, the project management system, and the management organization are described in these sections.

23221 (ORNL/TM–12938) **Evaluation of selected ion exchangers for the removal of cesium from MVST W-25 supernate.** Collins, J.L.; Egan, B.Z.; Anderson, K.K.; Chase, C.W.; Mrochek, J.E.; Bell, J.T.; Jernigan, G.E. Oak Ridge National Lab., TN (United States). Apr 1995. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013798. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of this batch-test equilibration study was to evaluate the effectiveness of certain ion exchangers for removing cesium from supernate taken from tank W-25 of the Melton Valley Storage Tank (MVST) Facility located at the Oak Ridge National Laboratory (ORNL). These exchangers were selective for removing cesium from alkaline supernatant solutions with high salt concentrations. Since the supernates of evaporator concentrates stored in tanks at the MVST facility have compositions similar to some of those stored in tanks at Hanford, the data generated in this study should prove useful in the overall evaluation of the ion exchangers for applications to Hanford and other US Department of Energy (USDOE) sites. A goal of the waste processing effort at Hanford is to remove enough cesium to ensure that the resulting LLW will meet the Nuclear Regulatory Commission (NRC) 10 CFR 61 class A limit for ^{137}Cs (1 Ci/m^3 or 1 μCi/mL). The separated cesium may be concentrated and vitrified for disposal in the high-level waste repository. The decontaminated effluent would be solidified for near-surface disposal.

23222 (ORNL/TM–13007) **Technical support for the Ukrainian State Committee for Nuclear Radiation Safety on specific waste issues.** Little, C.A. Oak Ridge National Lab., TN (United States). [1995]. 25p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. Source: OSTI; NTIS; INIS.

The government of Ukraine, a now-independent former member of the Soviet Union, has asked the United States to assist its State Committee for Nuclear and Radiation Safety (SCNRS) in improving its regulatory control in technical fields for which it has responsibility. The US Nuclear Regulatory Commission (NRC) is providing this assistance in several areas, including management of radioactive waste and spent fuel. Radioactive wastes resulting from nuclear power plant operation, maintenance, and decommissioning must be stored and ultimately disposed of appropriately. In addition, radioactive residue from radioisotopes used in various industrial and medical applications must be managed. The objective of this program is to provide the Ukrainian SCNRS with the information it needs to establish regulatory control over uranium mining and milling activities in the Zheltye Vody (Yellow Waters) area and radioactive waste disposal in the Pripyat (Chernobyl) area among others. The author of this report, head of the Environmental Technology Section, Health Sciences Research Division of Oak Ridge National Laboratory, accompanied NRC staff to Ukraine to meet with SCNRS staff and visit sites in question. The report highlights problems at the sites visited and recommends license conditions that SCNRS can require to enhance safety of handling mining and milling wastes. The author's responsibility was specifically for the visit to Zheltye Vody and the mining and milling waste sites associated with that facility. An itinerary for the Zheltye Vody portion of the trip is included as Appendix A.

23223 (ORNL/TM–13034) **A facility design for repackaging ORNL CH-TRU legacy waste in Building 3525.** Huxford, T.J. (Oak Ridge National Lab., TN (United States)); Cooper, R.H. Jr.; Davis, L.E.; Fuller, A.B.; Gabbard, W.A.; Smith, R.B.; Guay, K.P.; Smith, L.C. Oak Ridge National Lab., TN (United States). Jul 1995. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95008645. Source: OSTI; NTIS; INIS; GPO Dep.

For the last 25 years, the Oak Ridge National Laboratory (ORNL) has conducted operations which have generated solid, contact-handled transuranic (CH-TRU) waste. At present the

CH-TRU waste inventory at ORNL is about 3400 55-gal drums retrievably stored in RCRA-permitted, aboveground facilities. Of the 3400 drums, approximately 2600 drums will need to be repackaged. The current US Department of Energy (DOE) strategy for disposal of these drums is to transport them to the Waste Isolation Pilot Plant (WIPP) in New Mexico which only accepts TRU waste that meets a very specific set of criteria documented in the WIPP-WAC (waste acceptance criteria). This report describes activities that were performed from January 1994 to May 1995 associated with the design and preparation of an existing facility for repackaging and certifying some or all of the CH-TRU drums at ORNL to meet the WIPP-WAC. For this study, the Irradiated Fuel Examination Laboratory (IFEL) in Building 3525 was selected as the reference facility for modification. These design activities were terminated in May 1995 as more attractive options for CH-TRU waste repackaging were considered to be available. As a result, this document serves as a final report of those design activities.

23224 (PNL–8040) **Extrapolation of creep behavior of high-density polyethylene liner in the Catch Basin of grout vaults.** Whyatt, G.A. Pacific Northwest Lab., Richland, WA (United States). Jul 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015838. Source: OSTI; NTIS; INIS; GPO Dep.

Testing was performed to determine if gravel particles will creep into and puncture the high-density polyethylene (HDPE) liner in the catch basin of a grout vault over a nominal 30-year period. Testing was performed to support a design without a protective geotextile cover after the geotextile was removed from the design. Recently, a protective geotextile cover over the liner was put back into the design. The data indicate that the geotextile has an insignificant effect on the creep of gravel into the liner. However, the geotextile may help to protect the liner during construction. Two types of tests were performed to evaluate the potential for creep-related puncture. In the first type of test, a very sensitive instrument measured the rate at which a probe crept into HDPE over a 20-minute period at temperatures of 176°F to 212°F (80°C to 100°C). The second type of test consisted of placing the liner between gravel and mortar at 194°F (90°C) and 45.1 psi overburden pressure for periods up to 1 year. By combining data from the two tests, the long-term behavior of the creep was extrapolated to 30 years of service. After 30 years of service, the liner will be in a nearly steady condition and further creep will be extremely small. The results indicate that the creep of gravel into the liner will not create a puncture during service at 194°F (90°C). The estimated creep over 30 years is expected to be less than 25 mils out of the total initial thickness of 60 mils. The test temperature of 194°F (90°C) corresponds to the design basis temperature of the vault. Lower temperatures are expected at the liner, which makes the test conservative. Only the potential for failure of the liner resulting from creep of gravel is addressed in this report.

23225 (PNL–10360) **Analysis of organic carbon and moisture in Hanford single-shell tank waste.** Toth, J.J.; Heasler, P.G.; Lerchen, M.E.; Hill, J.G.; Whitney, P.D. Pacific Northwest Lab., Richland, WA (United States). May 1995. 162p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014506. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents a revised analysis performed by Pacific Northwest Laboratory involving the organic carbon laboratory measurement data for Hanford single-shell tanks (SSTs) obtained from a review of the laboratory analytical data. This activity has as its objective to provide a best-estimate, including confidence levels, of total organic carbon (TOC) and moisture in each of the 149 SSTs at Hanford. The TOC and moisture information presented in this report is useful as part of the criteria to identify SSTs for additional measurements, or monitoring for the Organic Safety Program. In April 1994, an initial study of the organic carbon in Hanford single-shell tanks was completed at PNL. That study reflected the estimates of TOC based on tank characterizations datasets that were available at the time. Also in that study, estimation of dry basis TOC was based on generalized assumptions pertaining to the moisture of the tank wastes. The new information pertaining to tank moisture and TOC data that has become available from the current study influences the best estimates of TOC in each of the SSTs. This investigation of tank TOC and moisture has resulted in improved estimates based on waste phase: saltcake, sludge, or liquid. This report details the assumptions and methodologies used to develop the estimates of TOC and moisture in each of the 149 SSTs at Hanford.

23226 (PNL–10460) **Inorganic ion exchange evaluation and design: Silicotitanate ion exchange waste conversion.** Balmer, M.L.; Bunker, B.C. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95011683. Source: OSTI; NTIS; INIS; GPO Dep.

Ion exchange materials are being evaluated for removing Cs, SR from tank waste. Thermal conversion of a variety of compositions within the Cs_2O-TiO_2-SiO_2 phase diagram yielded both glass and crystalline materials, some of which show low leach rates and negligible Cs losses during heat treatment. A new material, $CsTiSi_2O_6$, with a structure isomorphous to pollucite ($CsAlSi_2O_6$) has been identified. This material represents a new class of crystalline zeolite materials which contain large amounts of titanium. Direct conversion of Cs loaded silicotitanate ion exchangers to $CsTiSi_2O_6$ is an excellent alternative to dissolving the Cs-loaded or Cs-eluted exchangers in borosilicate glass because: $CsTiSi_2O_6$ is formed using a simple, one step heat treatment. The unique crystalline pollucite-like structure of $CsTiSi_2O_6$ traps Cs, and exhibits extremely low Cs leach rates. $CsTiSi_2O_6$ is converted to solid waste at a low processing temperature of 700 to 800 C (nominal melter operating temperatures are 1150 C). $CsTiSi_2O_6$ concentrates the waste, thus generating lower volumes of expensive HLW. Cs losses due to volatilization during processing of $CsTiSi_2O_6$ are extremely low.

23227 (PNL–10522) **Hanford stakeholder participation in evaluating innovative technologies: VOC product line, Passive soil vapor extraction using borehole flux tunable hybrid plasma.** Peterson, T.; McCabe, G.; Niesen, K.; Serie, P. Pacific Northwest Lab., Richland, WA (United States). May 1995. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95011869. Source: OSTI; NTIS; INIS; GPO Dep.

A three-phased stakeholder participation program was conducted to support the Volatile Organic Compounds Arid Site Integrated Demonstration (VOC-Arid ID). The US DOE's Office of Technology Development (OTD) sponsored and directed the VOC-Arid ID. Its purpose was to develop and demonstrate new technologies for remediating VOC contamination in soil and ground water. The integrated demonstration, hosted by the Hanford site in Washington State, is being transitioned into the Department of Energy's (DOE) Plume Focus Area. The Plume Focus Area has the same basic objectives as the ID, but is broader in scope and is a team effort with technology developers and technology users. The objective is to demonstrate a promising technology once, and if results warrant deploy it broadly across the DOE complex and in private sector applications.

23228 (PNL–10589) **Tank Waste Remediation System Guide.** Robershotte, M.A.; Dirks, L.L.; Seaver, D.A.; Bothers, A.J.; Madden, M.S. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015134. Source: OSTI; NTIS; INIS; GPO Dep.

The scope, number and complexity of Tank Waste Remediation System (TWRS) decisions require an integrated, consistent, and logical approach to decision making. TWRS has adopted a seven-step decision process applicable to all decisions. Not all decisions, however, require the same degree of rigor/detail. The decision impact will dictate the appropriate required detail. In the entire process, values, both from the public as well as from the decision makers, play a key role. This document concludes with a general discussion of the implementation process that includes the roles of concerned parties.

23229 (PNL–10600) **Storage of LWR spent fuel in air. Volume 3, Results from exposure of spent fuel to fluorine-contaminated air.** Cunningham, M.E.; Thomas, L.E. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 371p.

Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015594. Source: OSTI; NTIS; INIS; GPO Dep.

The Behavior of Spent Fuel in Storage (BSFS) Project has conducted research to develop data on spent nuclear fuel (irradiated UO_2) that could be used to support design, licensing, and operation of dry storage installations. Test Series B conducted by the BSFS Project was designed as a long-term study of the oxidation of spent fuel exposed to air. It was discovered after the exposures were completed in September 1990 that the test specimens had been exposed to an atmosphere of bottled air contaminated with an unknown quantity of fluorine. This exposure resulted in the test specimens reacting with both the oxygen and the fluorine in the oven atmospheres. The apparent source of the fluorine was gamma radiation-induced chemical decomposition of the fluoroelastomer gaskets used to seal the oven doors. This chemical decomposition apparently released hydrofluoric acid (HF) vapor into the oven atmospheres. Because the Test Series B specimens were exposed to a fluorine-contaminated oven atmosphere and reacted with the fluorine, it is recommended that the Test Series B data not be used to develop time-temperature limits for exposure of spent nuclear fuel to air. This report has been prepared to document Test Series B and present the collected data and observations.

23230 (PNL-SA–24720) **Hanford high level waste: Sample Exchange/Evaluation (SEE) Program.** King, A.G. Pacific Northwest Lab., Richland, WA (United States). Aug 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940815–113: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE95014639. Source: OSTI; NTIS; INIS; GPO Dep.

The Pacific Northwest Laboratory (PNL)/Analytical Chemistry Laboratory (ACL) and the Westinghouse Hanford Company (WHC)/ Process Analytical Laboratory (PAL) provide analytical support services to various environmental restoration and waste management projects/programs at Hanford. In response to a US Department of Energy – Richland Field Office (DOE-RL) audit, which questioned the comparability of analytical methods employed at each laboratory, the Sample Exchange/Exchange (SEE) program was initiated. The SEE Program is a selfassessment program designed to compare analytical methods of the PAL and ACL laboratories using sitespecific waste material. The SEE program is managed by a collaborative, the Quality Assurance Triad (Triad). Triad membership is made up of representatives from the WHC/PAL, PNL/ACL, and WHC Hanford Analytical Services Management (HASM) organizations. The Triad works together to design/evaluate/implement each phase of the SEE Program.

23231 (PNL-SA–24982) **Optimization of waste loading in high-level glass in the presence of uncertainty.** Hoza, M. (and others); Fann, G.I.; Hopkins, D.F. Pacific Northwest Lab., Richland, WA (United States). Feb 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950216–150: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95014167. Source: OSTI; NTIS; INIS; GPO Dep.

Hanford high-level liquid waste will be converted into a glass form for long-term storage. The glass must meet certain constraints on its composition and properties in order to have desired properties for processing (e.g., electrical conductivity, viscosity, and liquidus temperature) and acceptable durability for long-term storage. The Optimal Waste Loading (OWL) models, based on rigorous mathematical optimization techniques, have been developed to minimize the number of glass logs required and determine glass-former compositions that will produce a glass meeting all relevant constraints. There is considerable uncertainty in many of the models and data relevant to the formulation of high-level glass. In this paper, we discuss how we handle uncertainty in the glass property models and in the high-level waste composition to the vitrification process. Glass property constraints used in optimization are inequalities that relate glass property models obtained by regression analysis of experimental data to numerical limits on property values. Therefore, these constraints are subject to uncertainty. The sampling distributions of the regression models are used to describe the uncertainties associated with the constraints. The optimization then accounts for these uncertainties by requiring the constraints to be satisfied within specified confidence limits. The uncertainty in waste composition is handled using stochastic optimization. Given means and standard deviations of component masses in the high-level waste stream, distributions of possible values for each component are generated. A series of optimization runs is performed; the distribution of each waste component is sampled for each run. The resultant distribution of solutions is then statistically summarized. The ability of OWL models to handle these forms of uncertainty make them very useful tools in designing and evaluating high-level waste glasses formulations.

23232 (PNL-SA–25753) **A PC-based software package for modeling DOE mixed-waste management options.** Abashian, M.S. (IT Corp., Albuquerque, NM (United States)); Carney, C.; Schum, K. Pacific Northwest Lab., Richland, WA (United States). Feb 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950216–153: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95014171. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy (DOE) Headquarters and associated contractors have developed an IBM PC-based software package that estimates costs, schedules, and public and occupational health risks for a range of mixed-waste management options. A key application of the software package is the comparison of various waste-treatment options documented in the draft Site Treatment Plans prepared in accordance with the requirements of the Federal Facility Compliance Act of 1992. This automated Systems Analysis Methodology consists of a user interface for configuring complexwide or site-specific waste-management options; calculational algorithms for cost, schedule and risk; and user-selected graphical or tabular output of results. The mixed-waste management activities modeled in the automated Systems Analysis Methodology include waste storage, characterization, handling, transportation, treatment, and disposal. Analyses of treatment options identified in the draft Site Treatment Plans suggest potential cost and schedule savings from consolidation of proposed treatment facilities. This paper presents an overview of the automated Systems Analysis Methodology.

23233 (PNL-SA–25764) **Vitrification development for mixed wastes.** Merrill, R.; Whittington, K.; Peters, R. Pacific Northwest Lab., Richland, WA (United States). Feb 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950216–154: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95014190. Source: OSTI; NTIS; INIS; GPO Dep.

Vitrification is a promising approach to waste-form immobilization. It destroys hazardous organic compounds and produces a durable and highly stable glass. Vitrification tests were performed on three surrogate wastes during fiscal year 1994; 183-H Solar Evaporation Basin waste from Hanford, bottom ash from the Oak Ridge TSCA incinerator, and saltcrete from Rocky Flats. Preliminary glass development involved melting trials followed by visual homogeneity examination, short-duration leach tests on glass specimens, and long-term leach tests on selected glasses. Viscosity and electrical conductivity measurements were taken for the most durable glass formulations. Results for the saltcrete are presented in this paper and demonstrate the applicability of vitrification technology to this mixed waste.

23234 (PNL-SA–26071) **Waste forms based on Cs-loaded silicotitanates.** Balmer, M.L.; Bunker, B.C. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950401–18: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95014169. Source: OSTI; NTIS; INIS; GPO Dep.

Silicotitanate ion exchange materials are being considered for removal of radioactive Cs and Sr from tank wastes at the Hanford site. The phase evolution as a function of heat treatment temperature for several sol gel derived compositions within the Cs_2O-SiO_2-TiO_2 system was investigated, in order to determine if

an adequate waste form can be achieved by direct thermal conversion. The Cs leach rates and Cs loss during heat treatment of select materials were measured. Some compositions which contain large amounts of Ti melt to form a glass with reasonably low aqueous leach rates. A new Cs-silicotitanate material with a structure isomorphous to pollucite was discovered. This material forms at low temperatures (700–800 C) where Cs volatility is negligible. The silicotitanate-pollucite exhibits extremely low leach rates (1.42 g/m^2day) at 90 C, and has been identified as a promising waste form for Cs containment.

23235 (PNL-SA–26111) **Enterprise wide transparent information access.** Brown, J. Pacific Northwest Lab., Richland, WA (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9505236–1: Sybase Users Group conference, Dallas, TX (United States), 15-18 May 1995). Order Number DE95014198. Source: OSTI; NTIS; INIS; GPO Dep.

The information management needs of the Department of Energy (DOE) represents a fertile domain for the development of highly sophisticated yet intuitive enterprise-wide computing solutions. These solutions must support business operations, research agendas, technology development efforts, decision support, and other application areas with a user base ranging from technical staff to the highest levels of management. One area of primary interest is in the Environmental Restoration and Waste Management Branch of DOE. In this arena, the issue of tracking and managing nuclear waste related to the long legacy of prior defense production and research programs is one of high visibility and great concern. The Tank Waste Information Network System (TWINS) application has been created by the Pacific Northwest Laboratory (PNL) for the DOE to assist in managing and accessing the information related to this mission. The TWINS solution addresses many of the technical issues faced by other efforts to provide integrated information access to a wide variety of stakeholders. TWINS provides secure transparent access to distributed heterogeneous multimedia information sources from around the DOE complex. The users interact with the information through a consistent user interface that presents the desired data in a common format regardless of the structure of the source information. The solutions developed by the TWINS project represent an integration of several technologies and products that can be applied to other mission areas within DOE and other government agencies. These solutions are now being applied to public and private sector problem domains as well. The successful integration and inter-operation of both commercial and custom modules into a flexible and extensible information architecture will help ensure that new problems facing DOE and other clients can be addressed more rapidly in the future by re-use of existing tools and techniques proven viable through the TWINS efforts.

23236 (PNL-SA–26147) **Application of macro material flow modeling to the decision making process for integrated waste management systems.** Vigil, S.A. (California Polytechnic State Univ., San Luis Obispo, CA (United States)); Holter, G.M. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9504119–1: AWMA international speciality conference on thermal treatment and waste-to-energy technologies for solid waste management, Washington, DC (United States), 18-21 Apr 1995). Order Number DE95014635. Source: OSTI; NTIS; INIS; GPO Dep.

Computer models have been used for almost a decade to model and analyze various aspects of solid waste management Commercially available models exist for estimating the capital and operating costs of landfills, waste-to-energy facilities and compost systems and for optimizing system performance along a single dimension (e.g. cost or transportation distance). An alternative to the use of currently available models is the more flexible macro material flow modeling approach in which a macro scale or regional level approach is taken. Waste materials are tracked through the complete integrated waste management cycle from generation through recycling and reuse, and finally to ultimate disposal. Such an approach has been applied by the authors to two different applications. The STELLA simulation language (for Macintosh computers) was used to model the solid waste management system of Puerto Rico. The model incorporated population projections for all 78 municipalities in Puerto Rico from 1990 to 2010, solid waste generation factors, remaining life for the existing landfills, and projected startup time for new facilities. The Pacific Northwest Laboratory has used the SimScript simulation language (for Windows computers) to model the management of solid and hazardous wastes produced during cleanup and remediation activities at the Hanford Nuclear Site.

23237 (SAND–94-0379) **Formulation and numerical analysis of nonisothermal multiphase flow in porous media.** Martinez, M.J. (Sandia National Labs., Albuquerque, NM (United States). Engineering Sciences Center). Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013836. Source: OSTI; NTIS; INIS; GPO Dep.

A mathematical formulation is presented for describing the transport of air, water and energy through porous media. The development follows a continuum mechanics approach. The theory assumes the existence of various average macroscopic variables which describe the state of the system. Balance equations for mass and energy are formulated in terms of these macroscopic variables. The system is supplemented with constitutive equations relating fluxes to the state variables, and with transport property specifications. Specification of various mixing rules and thermodynamic relations completes the system of equations. A numerical simulation scheme, employing the method of lines, is described for one-dimensional flow. The numerical method is demonstrated on sample problems involving nonisothermal flow of air and water. The implementation is verified by comparison with existing numerical solutions.

23238 (SAND–95-0488/1) **Geotechnical characterization of the North Ramp of the Exploratory Studies Facility: Yucca Mountain Site Characterization Project. Volume 1, Data summary.** Brechtel, C.E. (Agapito Associates, Inc., Grand Junction, CO (United States)); Lin, Ming; Martin, E.; Kessel, D.S. Sandia National Labs., Albuquerque, NM (United States). May 1995. 304p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015011. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of geological and geotechnical characterization of the Miocene volcanic tuff rocks of the Timber Mountain and Paintbrush groups that the tunnel boring machine will encounter during excavation of the Exploratory Studies Facility (ESF) North Ramp. The is being constructed by the DOE as part of the Yucca Mountain Project site characterization activities. The purpose of these activities is to evaluate the feasibility of locating a potential high-level nuclear waste repository on lands adjacent to the Nevada Test Site, Nye County, Nevada. This report was prepared as part of the Soil and Rock Properties Studies in accordance with the 8.3.1.14.2 Study Plan. This report is volume 1 of the data summary.

23239 (SAND–95-0488/2) **Geotechnical characterization of the North Ramp of the Exploratory Studies Facility: Yucca Mountain Site Characterization Project. Volume 2, NRG core-hole data appendices.** Brechtel, C.E. (Agapito Associates, Inc., Grand Junction, CO (United States)); Lin, Ming; Martin, E.; Kessel, D.S. Sandia National Labs., Albuquerque, NM (United States). May 1995. 487p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015013. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of the geological and geotechnical characterization of the Miocene volcanic tuff rocks of the Timber Mountain and Paintbrush groups that the tunnel boring machine will encounter during excavations of the Exploratory Studies Facility (ESF) North Ramp. The information in this report was developed to support the design of the ESF North Ramp. The ESF is being constructed by the DOE as part of the Yucca Mountain Project site characterization activities. The purpose of these activities is to evaluate the potential to locate the national high-level nuclear waste repository on land within and adjacent to the Nevada Test Site (NTS), Nye County, Nevada. This report was prepared as part of the Soil and Rock Properties Studies in accordance with the 8.3.1.14.2 Study Plan to Provide Soil and Rock

Properties. This is volume 2 which contains NRG Corehole Data for each of the NRG Holes.

23240 (SAND–95-0776) **Passive soil venting at the Chemical Waste Landfill Site at Sandia National Laboratories, Albuquerque, New Mexico.** Phelan, J.M.; Reavis, B.; Cheng, W.C. Sandia National Labs., Albuquerque, NM (United States). May 1995. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013856. Source: OSTI; NTIS; INIS; GPO Dep.

Passive Soil Vapor Extraction was tested at the Chemical Waste Landfill (CWL) site at Sandia National Laboratories, New Mexico (SNLIW). Data collected included ambient pressures, differential pressures between soil gas and ambient air, gas flow rates into and out of the soil and concentrations of volatile organic compounds (VOCS) in vented soil gas. From the differential pressure and flow rate data, estimates of permeability were arrived at and compared with estimates from other studies. Flow, differential pressure, and ambient pressure data were collected for nearly 30 days. VOC data were collected for two six-hour periods during this time. Total VOC emissions were calculated and found to be under the limit set by the Resource Conservation and Recovery Act (RCRA). Although a complete process evaluation is not possible with the data gathered, some of the necessary information for designing a passive venting process was determined and the important parameters for designing the process were indicated. More study is required to evaluate long-term VOC removal using passive venting and to establish total remediation costs when passive venting is used as a polishing process following active soil vapor extraction.

23241 (SAND–95-1236) **Hanford coring bit temperature monitor development testing results report.** Rey, D. Sandia National Labs., Albuquerque, NM (United States). May 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014532. Source: OSTI; NTIS; INIS; GPO Dep.

Instrumentation which directly monitors the temperature of a coring bit used to retrieve core samples of high level nuclear waste stored in tanks at Hanford was developed at Sandia National Laboratories. Monitoring the temperature of the coring bit is desired to enhance the safety of the coring operations. A unique application of mature technologies was used to accomplish the measurement. This report documents the results of development testing performed at Sandia to assure the instrumentation will withstand the severe environments present in the waste tanks.

23242 (SAND–95-8615C) **P2 performance measurement tools workbook: Draft.** Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014354. Source: OSTI; NTIS; GPO Dep.

The underlying purpose of the Department of Energy's (DOE) Waste Minimization and Pollution Prevention (WMin/P2) Program is compliance with the waste management regulations set forth by the DOE, the federal government, and individual state and local agencies 1. In addition to these regulatory mandates, the increases in waste management costs and public interest in environmental issues have created other drivers to develop and demonstrate an effective WMin/P2 Program. The Waste Minimization Division (EM-334) must have adequate methods to calculate and roll up pollution prevention (P2) progress to meet the WMin/P2 requirements; these requirements support DOE and national objectives and direct funding. This document outlines a system to evaluate DOE's P2 progress towards the waste reduction requirements. The emphasis of these pollution prevention measurements is to evaluate whether P2 activities are effective, (i.e., has the required amount of waste been reduced as a result of the P2 activities) and to evaluate the cost management of P2 projects. The performance evaluation system presented in this document encompass these aspects: (1) site requirements that apply to all DOE waste generating organizations, (2) a baseline that is not affected by short-term waste generation, and (3) key indicators that can be rolled up across DOE sites and across specific Cognizant Secretarial Officers' (CSO) sites. In a performance-based management system, requirements are the fundamental link between the planning and measurement process. The site requirements are "targets" at the process or activity level. Measuring DOE's P2 progress toward these requirements provides the necessary feedback to (1) compare performance with the requirements/standards (i.e., whether the reduction requirement of 50% by 1999 is achievable) (2) detect departures from planned levels of performance, and (3) restore performance to the planned levels or achieve new levels of performance.

23243 (UCRL-ID–116187-94-9) **The Mixed Waste Management Facility. Monthly report, September 1994.** Streit, R. Lawrence Livermore National Lab., CA (United States). Oct 1994. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014136. Source: OSTI; NTIS; GPO Dep.

This document is a monthly report for September, 1994 of the significant developments that have taken place at the Mixed Waste Management Facility (MWMF) located at Lawrence Livermore National Laboratory (LLNL). This report presents a project financial summary, describes the quality assurance programs, project management, and presents a monthly summary of activities for the various treatment operations.

23244 (UCRL-ID–116187-95-4) **The Mixed Waste Management Facility monthly report, April 1995.** Streit, R.D. Lawrence Livermore National Lab., CA (United States). May 1995. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014397. Source: OSTI; NTIS; INIS; GPO Dep.

During late April, we modified the budget and work plan for FY95 to reflect a $2000K funding reduction for this fiscal year. These changes incorporate both the delayed start and slow ramp-up due to DOE funding uncertainties, as well as new and real reductions in Project activities. Due to the significant budgeting impact, this report reflects the resulting budget changes (for April). Scope and schedule impact, however, will be documented in the May report due to the additional effort involved in assessing schedule impact. We will combine the May Monthly Report and the Revised FY95 Plan for cost efficiency; we will submit the FY95 Plan Rebaseline for approval by DOE in May. Technical progress continued during April, but was redirected toward the new FY95 Plan. Key changes in the revised plan are to delete MEO from Project scope and wrap up work to date, defer further major procurements for the Project from FY95, delete MSO staff additions (with milestones), and defer work and milestones in other WBS elements. Engineering development, preliminary design, and peer reviews continued in preparation for the Project Preliminary Design Review. The budget reduction is executed to delay the Project Preliminary Design Review until QI of FY96.

23245 (UCRL-ID–116187-95-5) **The Mixed Waste Management Facility monthly report and revised FY95 plan, May 1995.** Streit, R.D. Lawrence Livermore National Lab., CA (United States). Jun 1995. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015416. Source: OSTI; NTIS; GPO Dep.

This report contains the project summary, as well as the financial summary for the Mixed Waste Management Facility at Lawrence Livermore National Laboratory. Detailed accomplishments and milestone status are reported in the Task Summaries. The major accomplishments during this reporting period are included the following areas: preliminary design; systems integration; briefings for the Environmental Programs Scientific Advisory Committee; integrated cost/scheduling estimating system; feed preparation; mediated electrochemical oxidation; and molten salt oxidation.

23246 (UCRL-ID–118561) **Review of sensors for the In situ chemical characterization of the Hanford underground storage tanks.** Kyle, K.R.; Mayes, E.L. Lawrence Livermore National Lab., CA (United States). 29 Jul 1994. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015026. Source: OSTI; NTIS; INIS; GPO Dep.

Lawrence Livermore National Laboratory (LLNL), in the Technical Task Plan (TTP) SF-2112-03 subtask 2, is responsible for the conceptual design of a Raman probe for inclusion in the in-tank cone penetrometer. As part of this task, LLNL is assigned the further responsibility of generating a report describing a review of sensor technologies other than Raman that can be incorporated in the

in-tank cone penetrometer for the chemical analysis of the tank environment. These sensors would complement the capabilities of the Raman probe, and would give information on gaseous, liquid, and solid state species that are insensitive to Raman interrogation. This work is part of a joint effort involving several DOE laboratories for the design and development of in-tank cone penetrometer deployable systems for direct UST waste characterization at Westinghouse Hanford Company (WHC) under the auspices of the U.S. Department of Energy (DOE) Underground Storage Tank Integrated Demonstration (UST-ID).

23247 (UCRL-ID–119720-Add.1) **Expedited demonstration of molten salt mixed waste treatment technology. Addendum 1.** Holtz, E.H. von; Hopper, R.W.; Adamson, M.G. Lawrence Livermore National Lab., CA (United States). 27 Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013430. Source: OSTI; NTIS; INIS; GPO Dep.

The Final Forms portion (Section 4) of the TTP SF-2410-03 final report was incomplete. This was noted under the subsection "Task Variances." The present report documents the work that was unfinished at that time, arranged in accord with the subsections of the Final Report. An assessment of the overall immobilization efficacy of polymer microencapsulation, as supported by this study, has been added. The study and demonstration of the polyethylene microencapsulation of salt residues is continuing under other auspices. A stand-alone report combining the results of the continuation with the contents of this memorandum and of Section 4 of the Final Report will be issued in later this year.

23248 (UCRL-ID–120683) **The mixed waste management facility. Project baseline revision 1.2.** Streit, R.D.; Throop, A.L. Lawrence Livermore National Lab., CA (United States). Apr 1995. 227p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015034. Source: OSTI; NTIS; GPO Dep.

Revision 1.2 to the Project Baseline (PB) for the Mixed Waste Management Facility (MWMF) is in response to DOE directives and verbal guidance to (1) Collocate the Decontamination and Waste Treatment Facility (DWTF) and MWMF into a single complex, integrate certain and overlapping functions as a cost-saving measure; (2) Meet certain fiscal year (FY) new-BA funding objectives ($15.3M in FY95) with lower and roughly balanced funding for out years; (3) Reduce Total Project Cost (TPC) for the MWMF Project; (4) Include costs for all appropriate permitting activities in the project TPC. This baseline revision also incorporates revisions in the technical baseline design for Molten Salt Oxidation (MSO) and Mediated Electrochemical Oxidation (MEO). Changes in the WBS dictionary that are necessary as a result of this rebaseline, as well as minor title changes, at WBS Level 3 or above (DOE control level) are approved as a separate document. For completeness, the WBS dictionary that reflects these changes is contained in Appendix B. The PB, with revisions as described in this document, were also the basis for the FY97 Validation Process, presented to DOE and their reviewers on March 21-22, 1995. Appendix C lists information related to prior revisions to the PB. Several key changes relate to the integration of functions and sharing of facilities between the portion of the DWTF that will house the MWMF and those portions that are used by the Hazardous Waste Management (HWM) Division at LLNL. This collocation has been directed by DOE as a cost-saving measure and has been implemented in a manner that maintains separate operational elements from a safety and permitting viewpoint. Appendix D provides background information on the decision and implications of collocating the two facilities.

23249 (UCRL-JC–120933) **Universal requisition for waste data collection.** Nisbet, B.; Gage, M. Lawrence Livermore National Lab., CA (United States). May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9505217–1: Air & Waste Management Association Policy meeting, Washington, DC (United States), 10-12 May 1995). Order Number DE95011695. Source: OSTI; NTIS; GPO Dep.

Lawrence Livermore National Laboratory (LLNL) has developed a data management tool for information gathering that encompasses all types of waste generated by the site. It is referred to as the Universal Requisition. It can be used to record information for the following types of waste: non-hazardous, hazardous, low level radioactive, mixed, transuranic (TRU), and TRU mixed wastestreams. It provides the salient information needed for the safe handling, storage, and disposal of waste, and satisfies our regulatory, record keeping, and reporting requirements. There are forty two numbered fields on the requisition and several other fields for signatures, compatibility codes, internal tracking numbers, and other information. Not all of these fields are applicable to every type of waste. As an aid to using the Universal requisition, templates with the applicable fields highlighted in color were produced and distributed. There are six different waste type templates. Each is highlighted in a different color.

23250 (UCRL-JC–120957) **Analysis of near-field thermal and psychometric waste package environment using ventilation.** Danko, G. (Univ. of Nevada, Reno, NV (United States). Mackay School of Mines); Buscheck, T.A.; Nitao, J.J.; Saterlie, S. Lawrence Livermore National Lab., CA (United States); Nevada Univ., Reno, NV (United States). Mackay School of Mines. Mar 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ; FC08-90NV10891. (CONF-9504179–3: 6. annual international conference on high level radioactive waste management, Las Vegas, NV (United States), 30 Apr - 5 may 1995). Order Number DE95015106. Source: OSTI; NTIS; INIS; GPO Dep.

The ultimate objective of the Civilian Radioactive Waste Management System (CRWMS) Program is to safely emplace and isolate the nations' spent nuclear fuel (SNF) and radioactive wastes in a geologic repository. Radioactive waste emplaced in a geologic repository will generate heat, increasing the temperature in the repository. The magnitude of this temperature increase depends upon (1) the heat source, i.e. the thermal loading of the repository, and (2) the geologic and engineered heat transport characteristics of the repository. Thermal management techniques currently under investigation include ventilation of the emplacement drifts during the preclosure period which could last as long as 100 years. Understanding the amount of heat and moisture removed from the emplacement drifts and near-field rock by ventilation, are important in determining performance of the engineered barrier system (EBS), as well as the corrosive environment of the waste packages, and the interaction of the EBS with the near-field host rock. Since radionuclide releases and repository system performance are significantly affected by the corrosion rate related to the psychometric environment, it is necessary to predict the amount of heat and moisture that are removed from the repository horizon using a realistic model for a wide range of thermal loading. This can be realized by coupling the hydrothermal model of the rock mass to a ventilation/climate model which includes the heat and moisture transport on the rock-air interface and the dilution of water vapor in the drift. This paper deals with the development of the coupled model concept, and determination of the boundary conditions for the calculations.

23251 (UCRL-JC–120966) **The value of assessments in Lawrence Livermore National Laboratory's Waste Certification Programs.** Ryan, E.M. Lawrence Livermore National Lab., CA (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9509131–2: 22. annual National Energy and Environmental Division education and training symposium, Charlotte, NC (United States), 17-20 Sep 1995). Order Number DE95013297. Source: OSTI; NTIS; INIS; GPO Dep.

This paper will discuss the value of assessments in Lawrence Livermore National Laboratory's Waste Certification Programs by: introducing the organization and purpose of the LLNL Waste Certification Programs for transuranic, low-level, and hazardous waste; examining the differences in internal assessment/audit requirements for these programs; discussing the values and costs of assessments in a waste certification program; presenting practical recommendations to maximize the value of your assessment programs; and presenting improvements in LLNL's waste certification processes that resulted from assessments.

23252 (UCRL-JC–120995) **Disposition of plutonium in deep boreholes.** Halsey, W.G.; Jardine, L.J.; Walter, C.E. Lawrence Livermore National Lab., CA (United States). May 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9505238–1: NATO international scientific exchange program advanced research workshop, St. Petersburg (Russian Federation), 14-17 May 1995). Order Number DE95013427. Source: OSTI; NTIS; GPO Dep.

Substantial inventories of excess plutonium are expected to result from dismantlement of U.S. and Russian nuclear weapons. Disposition of this material should be a high priority in both countries. A variety of disposition options are under consideration. One option is to place the plutonium either directly or in an immobilized form at the bottom of a deep borehole that is then sealed. Deep-borehole disposition involves placing plutonium several kilometers deep into old, stable, rock formations that have negligible free water present. Containment assurance is based on the presence of ancient groundwater indicating lack of migration and communication with the biosphere. Recovery would be extremely difficult (costly) and impossible to accomplish clandestinely.

23253 (USGS-OFR–93-89) **Ground-water altitudes and well data, Nye County, Nevada, and Inyo County, California.** Ciesnik, M.S. Geological Survey, Denver, CO (United States). 1995. 61p. Sponsored by USDOE, Washington, DC (United States);Department of the Interior, Washington, DC (United States). DOE Contract AI08-92NV10874. Order Number DE95011964. Source: OSTI; NTIS; INIS; U.S. Geological Survey, Earth Science Information Center, Box 25286, MS 517, Denver Federal Center, Denver, CO 80225(United States); GPO Dep.

This report contains ground-water altitudes and well data for wells located in Nye County, Nevada, and Inyo County, California, south of Yucca Mountain, Nevada, the potential site for a high-level nuclear waste repository. Data are from wells whose coordinates are within the Beatty and Death Valley Junction, California-Nevada maps from the US Geological Survey, scale 1:100,000 (30-minute × 60-minute quadrangle). Compilation of these data was made to provide a reference for numerical models of ground-water flow at Yucca Mountain and its vicinity. Water-level measurements were obtained from the US Geological Survey National Water Information System (NWIS) data base, and span the period of October 1951 to May 1991; most measurements were made from 1980 to 1990.

23254 (WHC-EP–0479-1) **Facility effluent monitoring plan for the tank farms facilities.** Bachand, D.D.; Crummel, G.M. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015658. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using specific guidelines. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years.

23255 (WHC-EP–0818) **Calcination/dissolution residue treatment.** Knight, R.C. (Westinghouse Hanford Co., Richland, WA (United States)); Creed, R.F.; Patello, G.K.; Hollenberg, G.W.; Buehler, M.F.; O'Rourke, S.M.; Visnapuu, A.; McLaughlin, D.F. Westinghouse Hanford Co., Richland, WA (United States). Sep 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013515. Source: OSTI; NTIS; INIS; GPO Dep.

Currently, high-level wastes are stored underground in steel-lined tanks at the Hanford site. Current plans call for the chemical pretreatment of these wastes before their immobilization in stable glass waste forms. One candidate pretreatment approach, calcination/dissolution, performs an alkaline fusion of the waste and creates a high-level/low-level partition based on the aqueous solubilities of the components of the product calcine. Literature and laboratory studies were conducted with the goal of finding a residue treatment technology that would decrease the quantity of high-level waste glass required following calcination/dissolution waste processing. Four elements, Fe, Ni, Bi, and U, postulated to be present in the high-level residue fraction were identified as being key to the quantity of high-level glass formed. Laboratory tests of the candidate technologies with simulant high-level residues showed reductive roasting followed by carbonyl volatilization to be successful in removing Fe, Ni, and Bi. Subsequent bench-scale tests on residues from calcination/dissolution processing of genuine Hanford Site tank waste showed Fe was separated with radioelement decontamination factors of 70 to 1,000 times with respect to total alpha activity. Thermodynamic analyses of the calcination of five typical Hanford Site tank waste compositions also were performed. The analyses showed sodium hydroxide to be the sole molten component in the waste calcine and emphasized the requirement for waste blending if fluid calcines are to be achieved. Other calcine phases identified in the thermodynamic analysis indicate the significant thermal reconstitution accomplished in calcination.

23256 (WHC-SA–2737) **Stress evaluation of the primary tank of a double-shell underground storage tank facility.** Atalay, M.B. (ICF Kaiser Engineers, Inc., Oakland, CA (United States)); Stine, M.D.; Farnworth, S.K. Westinghouse Hanford Co., Richland, WA (United States). Dec 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-950740–52: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95012565. Source: OSTI; NTIS; INIS; GPO Dep.

A facility called the Multi-Function Waste Tank Facility (MWTF) is being designed at the Department of Energy's Hanford site. The MWTF is expected to be completed in 1998 and will consist of six underground double-shell waste storage tanks and associated systems. These tanks will provide safe and environmentally acceptable storage capacity to handle waste generated during single-shell and double-shell tank safety mitigation and remediation activities. This paper summarizes the analysis and qualification of the primary tank structure of the MWTF, as performed by ICF Kaiser Hanford during the latter phase of Title 1 (Preliminary) design. Both computer finite element analysis (FEA) and hand calculations methods based on the so-called Tank Seismic Experts Panel (TSEP) Guidelines were used to perform the analysis and evaluation. Based on the evaluations summarized in this paper, it is concluded that the primary tank structure of the MWTF satisfies the project design requirements. In addition, the hand calculations performed using the methodologies provided in the TSEP Guidelines demonstrate that, except for slosh height, the capacities exceed the demand. The design accounts for the adverse effect of the excessive slosh height demand, i.e., inadequate freeboard, by increasing the hydrodynamic wall and roof pressures appropriately, and designing the tank for such increased pressures.

23257 (WHC-SA–2887) **In situ monitoring of grouted electrolytes.** Kahanda, G.L.M.K.S. (Brooklyn Coll., NY (United States). Dept. of Physics); Gu, Jingyan; Tomkiewicz, M.; Kruger, A.A. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95016340. Source: OSTI; NTIS; INIS; GPO Dep.

We describe conductivity measurements of grouts flooded with water and in contact with a sink that consists of pure water. The conductivity measurements were designed and carried out in parallel with present quality verification methods and standard leach test of the nuclear waste management industry. For the first time, we show that the method of replacing intrusive chemical analysis with conductivity measurements of the leaching samples yield equivalent results.

23258 (WHC-SD-C018H-ATP–004) **Project C-018H, 242-A evaporator/PUREX Plant Process Condensate Treatment Facility Instrumentation and Control (I&C).** Dupuis, A. Westinghouse Hanford Co., Richland, WA (United States). 26 May 1995. 34p.

Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014433. Source: OSTI; NTIS; INIS; GPO Dep.

This Acceptance Test Procedure (ATP) has been prepared to demonstrate that the Collection System Instrumentation & Control System for Project C-018H performs according to design. Specifically, this ATP is designed to verify the following overall system requirements: The input and outputs properly connected to the LCU terminal strips. The control system software conforms to the configuration specified by the logic diagrams, piping and instrumentation diagrams (P&ID), and the LERF operating philosophy. Testing will be performed using actual signals. If actual signals are not available, then simulated signals will be used to complete the tests.

23259 (WHC-SD-C018H-ATR–002) **Electrical/instrumentation acceptance test report for Project C-018H, 242-A Evaporator/ PUREX Plant condensate treatment facility.** Compau, R.A. Jr. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Kaiser Engineers Hanford Co., Richland, WA (United States). 1 Jun 1995. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014425. Source: OSTI; NTIS; INIS; GPO Dep.

This project is part of the 200 Area Effluent Treatment Facility. The acceptance test procedure describes test methods for leak detection units, pump flow switches, pump level control valves, room air temperature monitor, leachate pump status contacts, basin pump status contacts, catch basin leak detector, leachate level monitors, and basin level monitors. These are all components of the C-018H Collection System.

23260 (WHC-SD-CP-OTR–153) **PFP Wastewater Sampling Facility.** Hirzel, D.R. Westinghouse Hanford Co., Richland, WA (United States). 11 May 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012578. Source: OSTI; NTIS; INIS; GPO Dep.

This test report documents the results obtained while conducting operational testing of the sampling equipment in the 225-WC building, the PFP Wastewater Sampling Facility. The Wastewater Sampling Facility houses equipment to sample and monitor the PFP's liquid effluents before discharging the stream to the 200 Area Treated Effluent Disposal Facility (TEDF). The majority of the streams are not radioactive and discharges from the PFP Heating, Ventilation, and Air Conditioning (HVAC). The streams that might be contaminated are processed through the Low Level Waste Treatment Facility (LLWTF) before discharging to TEDF. The sampling equipment consists of two flow-proportional composite samplers, an ultrasonic flowmeter, pH and conductivity monitors, chart recorder, and associated relays and current isolators to interconnect the equipment to allow proper operation. Data signals from the monitors are received in the 234-5Z Shift Office which contains a chart recorder and alarm annunciator panel. The data signals are also duplicated and sent to the TEDF control room through the Local Control Unit (LCU). Performing the OTP has verified the operability of the PFP wastewater sampling system. This Operability Test Report documents the acceptance of the sampling system for use.

23261 (WHC-SD-EN-AP–165-Rev.1) **Interim-status groundwater monitoring plan for the 216-B-63 trench. Revision 1.** Sweeney, M.D. Westinghouse Hanford Co., Richland, WA (United States). 13 Jun 1995. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015656. Source: OSTI; NTIS; INIS; GPO Dep.

This document outlines the groundwater monitoring plan for interim-status detection-level monitoring of the 216-B-63 Trench. This is a revision of the initial groundwater monitoring plan prepared for Westinghouse Hanford Company (WHC) by Bjornstad and Dudziak (1989). The 216-B-63 Trench, located at the Hanford Site in south-central Washington State, is an open, unlined, earthern trench approximately 1.2 m (4 ft) wide at the bottom, 427 m (1400 ft) long, and 3 m (10 ft) deep that received wastewater containing hazardous waste and radioactive materials from B Plant, located in the 200 East Area. Liquid effluent discharge to the 216-B-63 Trench began in March 1970 and ceased in February 1992. The trench is now managed by Waste Tank Operations.

23262 (WHC-SD-EN-WP–012-Rev.1) **Groundwater screening evaluation/monitoring plan: 200 Area Treated Effluent Disposal Facility (Project W-049H). Revision 1.** Barnett, D.B.; Davis, J.D.; Collard, L.B.; Freeman, P.B.; Chou, C.J. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 225p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014429. Source: OSTI; NTIS; INIS; GPO Dep.

This report consists of the groundwater screening evaluation required by Section S.8 of the State Waste Discharge Permit for the 200 Area TEDF. Chapter 1.0 describes the purpose of the groundwater monitoring plan. The information in Chapter 2.0 establishes a water quality baseline for the facility and is the groundwater screening evaluation. The following information is included in Chapter 2.0: Facility description;Well locations, construction, and development data; Geologic and hydrologic description of the site and affected area; Ambient groundwater quality and current use; Water balance information; Hydrologic parameters; Potentiometric map, hydraulic gradients, and flow velocities; Results of infiltration and hydraulic tests; Groundwater and soils chemistry sampling and analysis data; Statistical evaluation of groundwater background data; and Projected effects of facility operation on groundwater flow and water quality. Chapter 3.0 defines, based on the information in Chapter 2.0, how effects of the TEDF on the environment will be evaluated and how compliance with groundwater quality standards will be documented in accordance with the terms and conditions of the permit. Chapter 3.0 contains the following information: Media to be monitored; Wells proposed as the point of compliance in the uppermost aquifer; Basis for monitoring well network and evidence of monitoring adequacy; Contingency planning approach for vadose zone monitoring wells; Which field parameters will be measured and how measurements will be made; Specification of constituents to be sampled and analyzed; and Specification of the sampling and analysis procedures that will be used. Chapter 4.0 provides information on how the monitoring results will be reported and the proposed frequency of monitoring and reporting. Chapter 5.0 lists all the references cited in this monitoring plan. These references should be consulted for additional or more detailed information.

23263 (WHC-SD-FF-HC–002-Rev.1) **Hazard categorization and baseline documentation for the Sodium Storage Facility. Revision 1.** Bowman, B.R. Westinghouse Hanford Co., Richland, WA (United States). 16 Jun 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95016341. Source: OSTI; NTIS; INIS; GPO Dep.

Hazard Categorization evaluation has been performed in accordance with DOE-STD-1027 for the Sodium Storage Facility at FFTF and a determination of less than Category 3 or non-nuclear has been made. Hazard Baseline Documentation has been performed in accordance with DOE-EM-STD-5502 and a determination of "Radiological Facility" has been made.

23264 (WHC-SD-SNF-ER–006-Rev.1) **105-KE Basin isolation barrier leak rate test analytical development. Revision 1.** Irwin, J.J. Westinghouse Hanford Co., Richland, WA (United States). 9 May 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015599. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides an analytical development in support of the proposed leak rate test of the 105-KE Basin. The analytical basis upon which the K-basin leak test results will be used to determine the basin leakage rates is developed in this report. The leakage of the K-Basin isolation barriers under postulated accident conditions will be determined from the test results. There are two fundamental flow regimes that may exist in the postulated K-Basin leakage: viscous laminar and turbulent flow. An analytical development is presented for each flow regime. The basic geometry and nomenclature of the postulated leak paths are denoted.

23265 (WHC-SD-SNF-PLN–007) **Plan for characterization of K Basin spent nuclear fuel and sludge.** Lawrence, L.A.; Marschman, S.C. Westinghouse Hanford Co., Richland, WA (United States). Jun 1995. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015586. Source: OSTI; NTIS; INIS; GPO Dep.

This plan outlines a characterization program that supports the accelerated Path Forward scope and schedules for the Spent Nuclear Fuel stored in the Hanford K Basins. This plan is driven by the schedule to begin fuel transfer by December 1997. The program is structured for 4 years and is limited to in-situ and laboratory examinations of the spent nuclear fuel and sludge in the K East and K West Basins. The program provides bounding behavior of the fuel, and verification and acceptability for three different sludge disposal pathways. Fuel examinations are based on two shipping campaigns for the K West Basin and one from the K East Basin. Laboratory examinations include physical condition, hydride and oxide content, conditioning testing, and dry storage behavior.

23266 (WHC-SD-SQA-CSA–20392) **CSER 95-005: PFP vertical denitration calciner.** Geiger, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014430. Source: OSTI; NTIS; INIS; GPO Dep.

The Vertical Denitrating Calciner system will stabilize certain unique solutions containing fissile salts by removing the water and nitrate ion to produce a more easily stored powder. This end is achieved by high-firing the solution in the calciner. The resultant calcine is distinguished by particles which are larger and denser than those produced by the more conventional oxalate precipitation process. This criticality safety evaluation report examines criticality safety for the denitration system, installed in glovebox 188-1 at PFP. The examination shows that, due to the incorporation of standard criticality safety design techniques, the glovebox can be maintained subcritical with minimal reliance on administrative controls. The examination also shows that, ignoring the necessary administrative controls can make a criticality possible in glovebox 188-1. Section 3.0 of this report lists the necessary administrative controls.

23267 (WHC-SD-W079-ES–001-Rev.3) **Hot sample archiving. Revision 3.** McVey, C.B. Westinghouse Hanford Co., Richland, WA (United States). 26 May 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013883. Source: OSTI; NTIS; INIS; GPO Dep.

This Engineering Study revision evaluated the alternatives to provide tank waste characterization analytical samples for a time period as recommended by the Tank Waste Remediation Systems Program. The recommendation of storing 40 ml segment samples for a period of approximately 18 months (6 months past the approval date of the Tank Characterization Report) and then composite the core segment material in 125 ml containers for a period of five years. The study considers storage at 222-S facility. It was determined that the critical storage problem was in the hot cell area. The 40 ml sample container has enough material for approximately 3 times the required amount for a complete laboratory re-analysis. The final result is that 222-S can meet the sample archive storage requirements. During the 100% capture rate the capacity is exceeded in the hot cell area, but quick, inexpensive options are available to meet the requirements.

23268 (WHC-SD-W236A-ES–014) **Multi-function Waste Tank Facility path forward engineering analysis – Technical Task 3.6, Estimate of operational risk in 200 West Area.** Coles, G.A. Westinghouse Hanford Co., Richland, WA (United States). 28 Apr 1995. 201p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012566. Source: OSTI; NTIS; INIS; GPO Dep.

Project W-0236A has been proposed to provide additional waste tank storage in the 200 East and 200 West Areas. This project would construct two new waste tanks in the 200 West Area and four new tanks in the 200 East Area, and a related project (Project W-058) would construct a new cross-site line. These projects are intended to ensure sufficient space and flexibility for continued tank farm operations, including tank waste remediation and management of unforeseen contingencies. The objective of this operational risk assessment is to support determination of the adequacy of the free-volume capacity provided by Projects W-036A and W-058 and to determine related impacts. The scope of the assessment is the 200 West Area only and covers the time period from the present to the year 2005. Two different time periods were analyzed because the new cross-site tie line will not be available until 1999. The following are key insights: success of 200 West Area tank farm operations is highly correlated to the success of the cross-site transfer line and the ability of the 200 East Area to receive waste from 200 West; there is a high likelihood of a leak on a complexed single-shell tank in the next 4 years (sampling pending); there is a strong likelihood, in the next 4 years, that some combination of tank leaks, facility upsets, and cross-site line failure will require more free tank space than is currently available in Tank 241-SY-102; in the next 4 to 10 years, there is a strong likelihood that a combination of a cross-site line failure and the need to accommodate some unscheduled waste volume will require more free tank space than is presently available in Tank 241-SY-102; the inherent uncertainty in volume projections is in the range of 3 million gallons; new million-gallon tanks increase the ability to manage contingencies and unplanned events.

23269 (WHC-SD-W252-FHA–001) **WHC-SD-W252-FHA-001, Rev. 0: Preliminary fire hazard analysis for Phase II Liquid Effluent Treatment and Disposal Facility, Project W-252.** Barilo, N.F. Westinghouse Hanford Co., Richland, WA (United States). 11 May 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013889. Source: OSTI; NTIS; INIS; GPO Dep.

A Fire Hazards Analysis was performed to assess the risk from fire and other related perils and the capability of the facility to withstand these hazards. This analysis will be used to support design of the facility.

23270 (WHC-SD-WM-ATP–128-Rev.1) **Operator coil monitoring acceptance test procedure.** Erhart, M.F. Westinghouse Hanford Co., Richland, WA (United States). 5 Jun 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014423. Source: OSTI; NTIS; GPO Dep.

The readiness of the Data Acquisition and Control System (DACS) to provide monitoring and control of the Programmable Logic Controller (PLC) abort coils from the Master and RSS stations will be systematically tested during performance of this procedure. It should be noted that these are not physical abort coils but software coils controlled by the software's ladder logic. The readiness of the DACS to properly interface with the ENRAF wire level gauge installed in the SY101 storage tank will also be tested. During this test, a verification of all abort coil indications will be conducted at the DACS Development Facility in the 306E Building by injecting an input signal for each DACS sensor that has an associated abort coil until the abort coil actuates, and then ensuring that the status of the abort coil indicated at the Master and RSS stations correct. Each abort coil will also be tested to ensure that the "ENABLE" and "DISABLE" controls from the Master and RSS stations function correctly, and only with the use of proper passwords.

23271 (WHC-SD-WM-ATP–132) **In situ vapor sampling system test procedure.** Deford, D.K. Westinghouse Hanford Co., Richland, WA (United States). 19 Jun 1995. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95016327. Source: OSTI; NTIS; INIS; GPO Dep.

This test procedure verifies the adequacy of the improved in situ vapor sampling system designed for sampling of vapors in underground radioactive waste storage tanks.

23272 (WHC-SD-WM-DA–148) **Structural evaluation of mixer pump installed in Tank 241-AN-107 for caustic addition project.** Leshikar, G.A. Westinghouse Hanford Co., Richland, WA (United States). 16 Jun 1995. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015790. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the structural analysis and evaluation of a mixer pump and caustic addition system to be used in Tank 107-AN. This pump will be installed in the central pump pit of this double- shell tank for the purpose of bringing the hydroxide ion concentration into compliance with Tank Farm operating specifications.

23273 (WHC-SD-WM-DA–196) **Structural analysis of 241C106 contingency chiller design.** Graves, C.E.; Coverdell,

B.L.; Nawarynsky, D.A.; Rensink, G.E. Westinghouse Hanford Co., Richland, WA (United States). 26 May 1995. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014422. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Tank 24ICI06 leak contingency plan, a chiller coil is to be installed on the existing HEPA-filtered air inlet unit. A natural phenomenon-hazard analysis per SDC 4.1, Standard Architectural-Civil Design Criteria, Design Loads for Facilities, Revision 12, was performed on several components of the design using both hand calculations and COSMOS/M computer models. The design meets SOC 4.1 requirements for safety class 3 equipment.

23274 (WHC-SD-WM-DP–107) **45-Day safety screen results for Tank 241-U-201, push mode, cores 70, 73 and 74.** Sathyanarayana, P. Westinghouse Hanford Co., Richland, WA (United States). 4 May 1995. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012568. Source: OSTI; NTIS; INIS; GPO Dep.

Three core samples, each having two segments, from Tank 241-U-201 (U-201) were received by the 222-S Laboratories. Safety screening analysis, such as differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and total alpha activity were conducted on Core 70, Segment 1 and 2 and on Core 73, Segment 1 and 2. Core 74, Segment 1 and 2 were taken to test rotary bit in push mode sampling. No analysis was requested on Core 74, Segment 1 and 2. Analytical results for the TGA analyses for Core 70, Segment 1, Upper half solid sample was less than the safety screening notification limit of 17 percent water. Notification was made on April 27, 1995. No exotherm was associated with this sample. Analytical results are presented in Tables 1 to 4, with the applicable notification limits shaded.

23275 (WHC-SD-WM-DP–111) **45-Day safety screen results for Tank 241-C-101, auger sample 95-AUG-019.** Sasaki, L.M. Westinghouse Hanford Co., Richland, WA (United States). 11 May 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012586. Source: OSTI; NTIS; INIS; GPO Dep.

One auger sample from Tank 241-C-101 was received by the 222-S Laboratory and underwent safety screening analyses–differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and total alpha analysis–in accordance with the tank characterization plan. Analytical results for the TGA on the crust sample (the uppermost portion of the auger sample) (sample number S95T000823) were less than the safety screening notification limit of 17 weight percent water. Verbal and written notifications were made on May 3, 1995. No exotherms were observed in the DSC analyses and the total alpha results were well below the safety screening notification limit. This report includes the primary safety screening results obtained from the analyses and copies of all DSC and TGA raw data scans as requested per the TCP. Although not included in this report, a photograph of the extruded sample was taken and is available. This report also includes bulk density measurements required by Characterization Plant Engineering. Additional analyses (pH, total organic carbon, and total inorganic carbon) are being performed on the drainable liquid at the request of Characterization Process Control; these analyses will be reported at a later date in a final report for this auger sample. Tank C-101 is not part of any of the four Watch Lists.

23276 (WHC-SD-WM-DP–114) **60-day safety screen results and final report for tank 241-C-111, auger samples 95-Aug-002, 95-Aug-003, 95-Aug-016, and 95-Aug-017.** Rice, A.D. Westinghouse Hanford Co., Richland, WA (United States). 30 May 1995. 280p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014307. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the auger sampling events for underground waste tank C-111. The samples were shipped to the 222-S laboratories were they underwent safety screening analysis and primary ferricyanide analysis. The samples were analyzed for alpha total, total organic carbon, cyanide, Ni, moisture, and temperature differentials. The results of this analysis are presented in this document.

23277 (WHC-SD-WM-DP–115) **45-day safety screen results for tank 241-C-204, auger samples 95-Aug-022 and 95-Aug-023.** Conner, J.M. Westinghouse Hanford Co., Richland, WA (United States). 15 Aug 1995. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95016330. Source: OSTI; NTIS; INIS; GPO Dep.

Two auger samples from tank 241-C-204 (C-204) were received at the 222-S Laboratories and underwent safety screening analysis, consisting of differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and total alpha activity. The three samples submitted to energetics determination by DSC exceeded the notification limit. As required by the Tank Characterization Plan, the appropriate notifications were made within 24 hours of official confirmation that the limit was exceeded. Secondary analyses have been initiated. Results from secondary analyses will be included in a revision to this report.

23278 (WHC-SD-WM-DP–132) **45-day safety screen results and final report for tank 241-C-202, auger samples 95-Aug-026 and 95-Aug-027.** Baldwin, J.H. Westinghouse Hanford Co., Richland, WA (United States). 19 Jun 1995. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95016329. Source: OSTI; NTIS; INIS; GPO Dep.

Two auger samples from tank 241-C-202 (C-202) were received at the 222-S Laboratories and underwent safety screening analysis, consisting of differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and total alpha activity. Two samples were submitted for energetics determination by DSC. Within the triplicate analyses of each sample, one of the results for energetics exceeded the notification limit. The sample and duplicate analyses for both augers exceeded the notification limit for TGA. As required by the Tank Characterization Plan, the appropriate notifications were made within 24 hours of official confirmation that the limits were violated.

23279 (WHC-SD-WM-ER–350) **Historical tank content estimate for the southeast quadrant of the Hanford 200 Areas.** ICF Kaiser Hanford Co., Richland, WA (United States). Jun 1995. 310p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015546. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides historical evaluations of the radioactive and mixed waste stored in the Hanford site underground double-shell tanks. A Historical Tank Content Estimate has been developed by reviewing the process histories, waste transfer data, and available physical and chemical characterization data from various Department of Energy and Department of Defense contractors. The historical data will supplement information that is currently being gathered from core sampling. Historical waste transfer and level data, tank physical information, temperature data, and sampling data have been compiled for this report and supporting documents.

23280 (WHC-SD-WM-ER–366) **Tank characterization report for Double-Shell Tank 241-SY-102.** DiCenso, A.T. (Los Alamos Technical Associates, Inc., NM (United States)); Amato, L.C.; Winters, W.I. Westinghouse Hanford Co., Richland, WA (United States). 9 Jun 1995. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014306. Source: OSTI; NTIS; INIS; GPO Dep.

This tank characterization report presents an overview of Double-Shell Tank 241-SY-102 (hereafter, Tank 241-SY-102) and its waste contents. It provides estimated concentrations and inventories for the waste components based on the latest sampling and analysis activities and background tank information. This report describes the results of three sampling events. The first core sample was taken in October 1988. The tank supernate and sludge were next core sampled in February and March of 1990 (Tingey and Sasaki 1995). A grab sample of the supernate was taken in March of 1994. Tank 241-SY-102 is in active service and can be expected to have additional transfers to and from the tank that will alter the composition of the waste. The concentration and inventory estimates reported in this document no longer reflect the exact composition of the waste but represent the best estimates based

on the most recent and available data. This report supports the requirements of the Hanford Federal Facility Agreement and Consent Order Milestone M-44-08 (Ecology, EPA, DOE 1994).

23281 (WHC-SD-WM-ER–418) **Tank 241-BY-104 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012592. Source: OSTI; NTIS; INIS; GPO Dep.

Tank BY-104 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. Tank BY-104 using the vapor sampling system (VSS) on June 24, 1994 by WHC Sampling and Mobile Laboratories. Air from the tank BY-104 headspace was withdrawn via a heated sampling probe mounted in riser 10A, and transferred via heated tubing to the VSS sampling manifold. Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories, Pacific Northwest Laboratories, and Oregon Graduate Institute of Science and Technology through a contract with Sandia National Laboratories. The 46 tank air samples and 2 ambient air control samples collected are listed in Table X-1 by analytical laboratory. Table X-1 also lists the 10 trip blanks provided by the laboratories.

23282 (WHC-SD-WM-ER–419) **Tank 241-BY-105 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012591. Source: OSTI; NTIS; INIS; GPO Dep.

Tank BY-105 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. Tank BY-105 is on the Ferrocyanide Watch List. Samples were collected from Tank BY-105 using the vapor sampling system (VSS) on July 7, 1994 by WHC Sampling and Mobile Laboratories. The tank headspace temperature was determined to be 26 C. Air from the Tank BY-105 headspace was withdrawn via a heated sampling probe mounted in riser 10A, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 65 C. Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories, Pacific Northwest Laboratories, and Oregon Graduate Institute of Science and Technology through a contract with Sandia National Laboratories. The 46 tank air samples and 2 ambient air control samples collected are listed in Table X-1 by analytical laboratory. Table X-1 also lists the 10 trip blanks provided by the laboratories.

23283 (WHC-SD-WM-ER–420) **Tank 241-BY-106 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012571. Source: OSTI; NTIS; INIS; GPO Dep.

Tank BY-106 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. Tank BY-106 is on the Ferrocyanide Watch List. Samples were collected from Tank BY-106 using the vapor sampling system (VSS) on July 8, 1994 by WHC Sampling and Mobile Laboratories. The tank headspace temperature was determined to be 27 C. Air from the Tank BY-106 headspace was withdrawn via a heated sampling probe mounted in riser 10B, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 65 C. Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories, Pacific Northwest Laboratories, and Oregon Graduate Institute of Science and Technology through a contract with Sandia National Laboratories. The 46 tank air samples and 2 ambient air control samples collected are listed in Table X-1 by analytical laboratory. Table X-1 also lists the 10 trip blanks provided by the laboratories.

23284 (WHC-SD-WM-ER–422) **Tank 241-BY-108 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012585. Source: OSTI; NTIS; INIS; GPO Dep.

Tank BY-108 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. Tank BY-108 is on the Ferrocyanide Watch List. Samples were collected from Tank BY-108 using the vapor sampling system (VSS) on october 27, 1994 by WHC Sampling and Mobile Laboratories. The tank headspace temperature was determined to be 25.7 C. Air from the Tank BY-108 headspace was withdrawn via a 7.9 m-long heated sampling probe mounted in riser 1, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 50 C. Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories, and Pacific Northwest Laboratories. The 40 tank air samples and 2 ambient air control samples collected are listed in Table X-1 by analytical laboratory. Table X-1 also lists the 14 trip blanks and 2 field blanks that accompanied the samples.

23285 (WHC-SD-WM-ER–425) **Tank 241-C-111 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012593. Source: OSTI; NTIS; INIS; GPO Dep.

Tank C-111 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. Results presented here represent the best available data on the headspace constituents of Tank C-111. Almost all of the data in this report was obtained from samples collected on September 13, 1994.Data from 2 other sets of samples, collected on August 10, 1993 and June 20, 1994, are in generally good agreement with the more recent data. The tank headspace temperature was determined to be 27 C. Air from the Tank C-111 headspace was withdrawn via a 7.9 m-long heated sampling probe mounted in riser 6, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 50 C. Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories, Pacific Northwest Laboratories, and Oregon Graduate Institute of Science and Technology through a contract with Sandia National Laboratories. The 39 tank air samples and 2 ambient air control samples collected are listed in Table X-1 by analytical laboratory. Table X-1 also lists the 14 trip blanks provided by the laboratories. Tank C-111 is a single shell tank which received first-cycle decontamination waste from B Plant and was later used as a settling tank.

23286 (WHC-SD-WM-ER–426) **Tank 241-C-112 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012594. Source: OSTI; NTIS; INIS; GPO Dep.

Tank C-112 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. Tank C-112 is a single-shell tank which received first-cycle decontamination waste from B Plant and was later used as a settling tank. Samples were collected from Tank C-112 using the vapor sampling system (VSS) on August 11, 1994 by WHC Sampling and Mobile Laboratories. The tank headspace temperature was determined to be 28 C. Air from the Tank C-112 headspace was withdrawn via a 7.9 m-long heated sampling probe mounted in riser 4, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 50 C. Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories, Pacific Northwest Laboratories, and Oregon Graduate Institute of Science and Technology through a contract with Sandia National Laboratories. The 39 tank air samples and 2 ambient air control samples collected are listed in Table X-1 by analytical laboratory. Table X-1 also lists the 14 trip blanks and 2 field blanks provided by the laboratories.

23287 (WHC-SD-WM-ER–427) **Tank 241-C-106 process test report.** Bander, T.J. Westinghouse Hanford Co., Richland, WA (United States). 30 May 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014316. Source: OSTI; NTIS; INIS; GPO Dep.

This report evaluates the thermal hydraulic behavior of tank C-106 during and following the process test conducted from March 10, 1994 to June 15, 1994. During and following the process test the thermocouples on the thermocouple tree in riser No. 14 began to indicate significantly higher temperatures in the sludge than the low temperatures typically observed at this location. The thermocouples on the thermocouple tree in riser No. 8 during this same time period indicated temperature variations consistent with normal seasonal effects. This report summarizes the analyses conducted to understand the phenomena that caused the temperature history at riser No. 14.

23288 (WHC-SD-WM-ER–428) **Tank 241-BY-103 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 5 May 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012824. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-BY-103 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in "Program Plan for the Resolution of Tank Vapor Issues." Tank 241-BY-103 was vapor sampled in accordance with "Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution."

23289 (WHC-SD-WM-ER–429) **Tank 241-BY-110 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012595. Source: OSTI; NTIS; INIS; GPO Dep.

Tank BY-110 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. Tank BY-110 is on the Ferrocyanide Watch List. Samples were collected from Tank BY-110 using the vapor sampling system (VSS) on November 11, 1994 by WHC Sampling and Mobile Laboratories. The tank headspace temperature was determined to be 27 C. Air from the Tank BY-110 headspace was withdrawn via a 7.9 m-long heated sampling probe mounted in riser 12B, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 50 C. Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories, and Pacific Northwest Laboratories. The 40 tank air samples and 2 ambient air control samples collected are listed in Table X-1 by analytical laboratory. Table X-1 also lists the 14 trip blanks and 2 field blanks that accompanied the samples.

23290 (WHC-SD-WM-ER–430) **Waste tank headspace gas and vapor characterization reference guide.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012823. Source: OSTI; NTIS; INIS; GPO Dep.

This document is to serve as a reference guide for gas and vapor sample results presented in tank characterization reports. It describes sampling equipment, devices, and protocols, and sample collection and analysis methods common to all vapor samples.

23291 (WHC-SD-WM-ER–432) **Evaluation of remaining life of the double-shell tank waste systems.** Schwenk, E.B. Westinghouse Hanford Co., Richland, WA (United States). 4 May 1995. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012789. Source: OSTI; NTIS; INIS; GPO Dep.

A remaining life assessment of the DSTs (double-shell tanks) and their associated waste transfer lines, for continued operation over the next 10 years, was favorable. The DST assessment was based on definition of significant loads, evaluation of data for possible material degradation and geometric changes and evaluation of structural analyses. The piping assessment was based primarily on service experience.

23292 (WHC-SD-WM-ER–436) **Dropping of mixing pump in Tank 102-AP.** Jimenez, R.F. Westinghouse Hanford Co., Richland, WA (United States). 2 Jun 1995. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95016334. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this study is to examine dropping of the mixing pump in Tank 102-AP during its removal poses the risk of causing a leak in the tank bottom with attendant potential for public exposure from the leak. The purpose of this investigation is to examine the potential for causing such a leak (i.e., estimated frequency of leak occurrence); to qualitatively estimate leak magnitude if its is a credible event; and, finally to compare the worker hazard, in the installation of an impact limiter (should it be required), to that which the public might incur if a leak is manifest in the tank bottom. The ultimate goal of the study is, of course, to assess the need for installation of an impact limiter.

23293 (WHC-SD-WM-ER–450) **Tank 241-U-106 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013911. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the details of the Hanford waste tank characterization study for tank 241-U-106. The drivers and objectives of the headspace vapor sampling and analysis were in accordance with procedures that were presented in other reports. The vapor and headspace gas samples were collected to determine the potential risks to tank farm workers due to fugitive emissions from the tank.

23294 (WHC-SD-WM-ER–458) **Tank 241-C-101 vapor sampling and analysis tank characterization report.** Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013881. Source: OSTI; NTIS; INIS; GPO Dep.

Tank C-101 headspace gas and vapor samples were collected and analyzed to help determine the potential risks of fugitive emissions to tank farm workers. Gas and vapor samples from the Tank C-101 headspace were collected on July 7, 1994 using the in situ sampling (ISS) method, and again on September 1, 1994 using the more robust vapor sampling system (VSS). Gas and vapor concentrations in Tank C-101 are influenced by its connections to other tanks and its ventilation pathways. At issue is whether the organic vapors in Tank C-101 are from the waste in that tank, or from Tanks C-102 or C-103. Tank C-103 is on the Organic Watch List; the other two are not. Air from the Tank C-101 headspace was withdrawn via a 7.9-m long heated sampling probe mounted in riser 8, and transferred via heated tubing to the VSS sampling manifold. The tank headspace temperature was determined to be 34.0 C, and all heated zones of the VSS were maintained at approximately 50 C. Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories, Pacific Northwest Laboratories, and Oregon Graduate Institute of Science and Technology through a contract with Sandia National Laboratories. The 39 tank air samples and 2 ambient air control samples collected are listed in Table X-1 by analytical laboratory. Table X-1 also lists the 14 trip blanks and 2 field blanks provided by the laboratories.

23295 (WHC-SD-WM-ES–325) **Pre-1970 transuranic solid waste at the Hanford Site.** Greenhalgh, W.O. Westinghouse Hanford Co., Richland, WA (United States). 23 May 1995. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015784. Source: OSTI; NTIS; INIS; GPO Dep.

The document is based on a search of pre-1970 Hanford Solid Waste Records. The available data indicates seven out of thirty-one solid waste burial sites used for pre-1970 waste appear to be Transuranic (TRU). A burial site defined to be TRU contains >100 nCi/gm Transuranic nuclides.

23296 (WHC-SD-WM-ES–331) **Identification of potential transuranic waste tanks at the Hanford Site.** Colburn, R.P. Westinghouse Hanford Co., Richland, WA (United States). 5 May 1995. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012567. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to identify potential transuranic (TRU) material among the Hanford Site tank wastes for possible disposal at the Waste Isolation Pilot Plant (WIPP) as an alternative to disposal in the high-level waste (HLW) repository. Identification of such material is the initial task in a trade study suggested in WHC-EP-0786, Tank Waste Remediation System Decisions and Risk Assessment (Johnson 1994). The scope of this document is limited to the identification of those tanks that might be segregated from the HLW for disposal as TRU, and the bases for that selection. It is assumed that the tank waste will be washed to remove soluble inert material for disposal as low-level waste (LLW), and the washed residual solids will be vitrified for disposal. The actual recommendation of a disposal strategy for these materials will require a detailed cost/benefit analysis and is beyond the scope of this document.

23297 (WHC-SD-WM-ES–343) **Moisture monitoring and control system engineering study.** Carpenter, K.E.; Fadeff, J.G. Westinghouse Hanford Co., Richland, WA (United States). 16 May 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012588. Source: OSTI; NTIS; INIS; GPO Dep.

During the past 50 years, a wide variety of chemical compounds have been placed in the 149 single-shell tanks (SSTS) on the Hanford Site. A concern relating to chemical stability, chemical control, and safe storage of the waste is the potential for propagating reactions as a result of ferrocyanide-oxidizer and organic-oxidizer concentrations in the SSTS. Propagating reactions in fuel-nitrate mixtures are precluded if the amounts of fuel and moisture present in the waste are within specified limits. Because most credible ignition sources occur near the waste surface, the main emphasis of this study is toward monitoring and controlling moisture in the top 14 cm (5.5 in.) of waste. The purpose of this engineering study is to recommend a moisture monitoring and control system for use in SSTs containing sludge and saltcake. This study includes recommendations for: (1) monitoring and controlling moisture in SSTs; (2) the fundamental design criteria for a moisture monitoring and control system; and (3) criteria for the deployment of a moisture monitoring and control system in hanford Site SSTs. To support system recommendations, technical bases for selecting and using a moisture monitoring and control system are presented. Key functional requirements and a conceptual design are included to enhance system development and establish design criteria.

23298 (WHC-SD-WM-ES–345) **Development and determination of a single-shell tank interim stabilization pumping strategy.** Garvin, L.J.; Kujak, S.K. ICF Kaiser Hanford Co., Richland, WA (United States). 12 Jun 1995. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015819. Source: OSTI; NTIS; INIS; GPO Dep.

This activity plan addresses the technique and steps involved in simulating a riser installation in the dome of a single-shell waste storage tank by the used of a rotary drill rig. This simulation will provide information to avoid potential inadequacies in planning and field efforts in a nonradiological environment. Personnel can be trained in a nonradiological environmental while perfecting techniques for drilling and installing risers. It is essential that field equipment and installation procedures be perfected before the installation of risers in SSTs occurs. Time spent installing the actual risers in the SSTs will be minimized, aiding in safety of personnel and conformance to ALARA principles.

23299 (WHC-SD-WM-FRD–021) **Functions and requirements for Hanford single-shell tank leakage detection and monitoring.** Cruse, J.M.; Ohl, P.C. Westinghouse Hanford Co., Richland, WA (United States). 19 Apr 1995. 176p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011506. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides the initial functions and requirements for leakage detection and monitoring applicable to past and potential future leakage from the Hanford Site's 149 single-shell high-level waste tanks. This mission is a part of the overall mission of the Westinghouse Hanford Company Tank Waste Remediation System division to remediate the tank waste in a safe and acceptable manner. Systems engineering principles are being applied to this effort. This document reflects the an initial step in the systems engineering approach to decompose the mission into primary functions and requirements. The document is considered approximately 30% complete relative to the effort required to produce a final version that can be used to support demonstration and/or procurement of technologies. The functions and requirements in this document apply to detection and monitoring of below ground leaks from SST containment boundaries and the resulting soil contamination. Leakage detection and monitoring is invoked in the TWRS Program in three fourth level functions: (1) Store Waste, (2) Retrieve Waste, and (3) Disposition Excess Facilities (as identified in DOE/RL-92-60 Rev. 1, Tank Waste Remediation System Functions and Requirements).

23300 (WHC-SD-WM-PAP–062-Rev.1) **Statements of work for FY 1996 to 2001 for the Hanford Low-Level Tank Waste Performance Assessment Project.** Mann, F.M. Westinghouse Hanford Co., Richland, WA (United States). 7 Jun 1995. 292p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015748. Source: OSTI; NTIS; INIS; GPO Dep.

The statements of work for each activity and task of the Hanford Low-Level Tank Waste Performance Assessment project are given for the fiscal years 1996 through 2001. The end product of this program is approval of a final performance assessment by the Department of Energy in the year 2000.

23301 (WHC-SD-WM-PCP–010) **Process control plan for 242-A Evaporator Campaign 95-1.** Le, E.Q.; Guthrie, M.D. Westinghouse Hanford Co., Richland, WA (United States). 18 May 1995. 235p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013334. Source: OSTI; NTIS; INIS; GPO Dep.

The wastes from tanks 106-AP, 107-AP, and 106-AW have been selected to be candidate feed wastes for Evaporator Campaign 95-1. The wastes in tank 106-AP and 107-AP are primarily from B-Plant strontium processing and PUREX neutralized cladding removal, respectively. The waste in tank 106-AW originated primarily from the partially concentrated product from 242-A Evaporator Campaign 94-2. Approximately 8.67 million liters of waste from these tanks will be transferred to tank 102-AW during the campaign. Tank 102-AW is the dedicated waste feed tank for the evaporator and currently contains 647,000 liters of processable waste. The purpose of the 242-A Evaporator Campaign 95-1 Process Control Plan (hereafter referred to as PCP) is to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator and provide a general description of process strategies and activities which will take place during Campaign 95-1. The PCP also summarizes and presents a comprehensive characterization of the wastes in these tanks.

23302 (WHC-SD-WM-QAPP–009-Rev.2) **242-A Evaporator quality assurance plan. Revision 2.** Basra, T.S. Westinghouse Hanford Co., Richland, WA (United States). 4 May 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012575. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this quality assurance project plan (Plan) is to provide requirements for activities pertaining to sampling, shipping, and analyses associated with candidate feed tank samples for the 242-A Evaporator project. The purpose of the 242-A Evaporator project is to reduce the volume of aqueous waste in the Double Shell Tank (DST) System and will result in considerable savings to the disposal of mixed waste. The 242-A Evaporator feed stream originates from DSTs identified as candidate feed tanks. The 242-A Evaporator reduces the volume of aqueous waste contained in DSTs by boiling off water and sending the condensate (called process condensate) to the Liquid Effluent Retention Facility (LEPF) storage basin where it is stored prior to treatment in the Effluent

Treatment Facility (ETF). The objective of this quality assurance project plan is to provide the planning, implementation, and assessment of sample collection and analysis, data issuance, and validation activities for the candidate feed tanks.

23303 (WHC-SD-WM-RPT–159) **Disposal facility data for the interim performance.** Eiholzer, C.R. Westinghouse Hanford Co., Richland, WA (United States). 15 May 1995. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013360. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to identify and provide information on the waste package and disposal facility concepts to be used for the low-level waste tank interim performance assessment. Current concepts for the low-level waste form, canister, and the disposal facility will be used for the interim performance assessment. The concept for the waste form consists of vitrified glass cullet in a sulfur polymer cement matrix material. The waste form will be contained in a 2 x 2 x 8 meter carbon steel container. Two disposal facility concepts will be used for the interim performance assessment. These facility concepts are based on a preliminary disposal facility concept developed for estimating costs for a disposal options configuration study. These disposal concepts are based on vault type structures. None of the concepts given in this report have been approved by a Tank Waste Remediation Systems (TWRS) decision board. These concepts will only be used in th interim performance assessment. Future performance assessments will be based on approved designs.

23304 (WHC-SD-WM-RPT–160) **Survey package: Technical and contracting strategies for single-shell tank waste retrieval on the Hanford Site.** Ramsower, D.C. Westinghouse Hanford Co., Richland, WA (United States). 25 May 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013906. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company is interested in innovative, commercially available or adaptable retrieval system equipment, concepts, and contracting strategies that will ad to existing Hanford Site technology and significantly reduce cost and/or risk from the baseline retrieval approach of sluicing (hydraulically mining) the waste from the SSTs onsite. The objective of this request is to gather information from industry to identify and summarize a suite of retrieval-related components, systems, and contracting approaches. This information will be used to ensure that WHC understands the various waste retrieval alternative approaches, their risks, and their application on the Hanford Site tanks for those occasions when sluicing is not sufficiently effective, appropriate, or cost-effective. An additional objective is to facilitate industry's understanding of the tank and site interface requirements for SST waste retrieval and the complex statutory, legal, regulatory, labor, and other institutional standards being applied to the Hanford Site. This effort will identify and summarize retrieval solutions by the end of September 1996 so that a clear basis for future retrieval program decisions can be established.

23305 (WHC-SD-WM-TI–640) **Double shell tanks plutonium inventory assessment.** Tusler, L.A. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014319. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides an evaluation that establishes plutonium inventory estimates for all DSTs based on known tank history information, the DST plutonium inventory tracking system, tank characterization measurements, tank transfer records, and estimated average concentration values for the various types of waste. These estimates use data through December 31, 1994, and give plutonium estimates as of January 1, 1995. The plutonium inventory values for the DSTs are given in Section 31. The plutonium inventory estimate is 224 kg for the DSTs and 854 kg for the SSTs for a total of 1078 kg. This value compares favorably with the total plutonium inventory value of 981 kg obtained from the total plutonium production minus plutonium recovery analysis estimates.

23306 (WHC-SD-WM-TI–684) **Waste characterization of the 101-SY hydrogen mitigation mixing pump shipping container.** Gedeon, S.R. Westinghouse Hanford Co., Richland, WA (United States). 19 May 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013347. Source: OSTI; NTIS; INIS; GPO Dep.

The Hydrogen Mitigation Mixing Pump (HMMP) in Tank 241-SY-101 will need to be removed at some point. At that time, the HMMP will be placed in a shipping container and transferred to a designated onsite location depending on waste classification. This report shows how the radioactive material content of shipping container will be determined. Once the radioactive material loading is known, the waste classification of the container may be determined in accordance with established procedures.

23307 (WHC-SD-WM-TI–691) **Strategy for resolution of the Flammable Gas Safety Issue.** Johnson, G.D. Westinghouse Hanford Co., Richland, WA (United States). 25 Apr 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95011507. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to provide the general strategy for resolution of the flammable gas safety issue; it is not a detailed description of program activities. budgets and schedules. Details of the program activities have been issued (Johnson and Sherwood, 1994) and the information pertaining to budgets is provided in the FY 1995-1997 Multi-Year Work Plan for Tank Waste Remediation System (TWRS) (Program Element 1.1.1.2.02.). The key element in this strategy is to provide an understanding of the behavior of each of the Flammable Gas Watch List tanks. While a review of historical information does provide some insight, it is necessary to gather current information about the gases, behavior and nature of the waste,. and about the control systems that maintain and monitor the waste. Analysis of this information will enable TWRS to determine the best approach to place any tank in a safe condition, if it is found to be in an unsafe state.

23308 (WHC-SD-WM-TI–705) **Solid waste handling.** Parazin, R.J. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014305. Source: OSTI; NTIS; INIS; GPO Dep.

This study presents estimates of the solid radioactive waste quantities that will be generated in the Separations, Low-Level Waste Vitrification and High-Level Waste Vitrification facilities, collectively called the Tank Waste Remediation System Treatment Complex, over the life of these facilities. This study then considers previous estimates from other 200 Area generators and compares alternative methods of handling (segregation, packaging, assaying, shipping, etc.).

23309 (WHC-SD-WM-TP–169) **Liquid Effluent Monitoring Information System test plans releases 2.0 and 3.0.** Guettler, D.A. Westinghouse Hanford Co., Richland, WA (United States). 26 May 1995. 590p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014427. Source: OSTI; NTIS; INIS; GPO Dep.

The Liquid Effluent Monitoring Information System (LEMIS) is being developed as the organized information repository facility in support of the liquid effluent monitoring requirements of the Tri-Party Agreement. It is necessary to provide an automated repository into which the results from liquid effluent sampling will be placed. This repository must provide for effective retention, review, and retrieval of selected sample data by authorized persons and organizations. This System Architecture document is the aggregation of the DMR P+ methodology project management deliverables. Together they represent a description of the project and its plan through four Releases, corresponding to the definition and prioritization of requirements defined by the user.

23310 (WHC-SD-WM-TRP–224) **Ignitability testing for core drilling system. Final report.** Cashdollar, K.L. (Bureau of Mines, Pittsburgh, PA (United States). Pittsburgh Research Center); Furno, A.; Green, G.M.; Thomas, R.A.; Witwer, K.S. Westinghouse Hanford Co., Richland, WA (United States); Bureau of Mines, Pittsburgh, PA (United States). Pittsburgh Research Center. 15 Jun

1995. 207p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95016332. Source: OSTI; NTIS; INIS; GPO Dep.

As part of a study of the hazards of the inspection of nuclear waste material stored at the Hanford, WA site, the Department of Energy (DOE) and Westinghouse Hanford Company (WHC) have developed a core drilling system to sample the material in large waste storage tanks. In support of this work, the US Bureau of Mines has studied the probability of ignition while core drilling into simulated salt cake that was permeated with a flammable gas mixture. No ignitions were observed while core drilling into the salt-cake with or without a purge gas and no ignitions were observed while drilling into a steel plate.

23311 (WHC-SD-WM-TSAP–002) **Tank 241-B-106 push mode core sampling and analysis plan.** Conner, J.M. Westinghouse Hanford Co., Richland, WA (United States). 15 Jun 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015792. Source: OSTI; NTIS; INIS; GPO Dep.

This sampling and analysis plan identifies characterization objectives pertaining to sample collection, laboratory analytical evaluation, and reporting requirements in accordance with the Tank Safety Screening Data Quality Objective. This quality objective is part of the tank characterization plan for tank 241-B-106. This report also identifies procedures and requirements for collecting and characterizing samples form tank 241-B-106 by the push mode core sampling method.

23312 (WHC-SD-WM-VI–021) **Test Plan: Phase 1 demonstration of 3-phase electric arc melting furnace technology for vitrifying high-sodium content low-level radioactive liquid wastes.** Eaton, W.C. (ed.). Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 55p. Sponsored by USDOE, Washington, DC (United States);Department of the Interior, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014303. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a test plan for the conduct of electric arc vitrification testing by a vendor in support of the Hanford Tank Waste Remediation System (TWRS) Low-Level Waste (LLW) Vitrification Program. The vendor providing this test plan and conducting the work detailed within it [one of seven selected for glass melter testing under Purchase Order MMI-SVV-384216] is the US Bureau of Mines, Department of the Interior, Albany Research Center, Albany, Oregon. This test plan is for Phase I activities described in the above Purchase Order. Test conduct includes feed preparation activities and melting of glass with Hanford LLW Double-Shell Slurry Feed waste simulant in a 3-phase electric arc (carbon electrode) furnace.

23313 (WHC-SD-WM-WP–303) **Half-liter supernatant sampler system engineering work plan.** Ritter, G.A. Westinghouse Hanford Co., Richland, WA (United States). 6 Jun 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014406. Source: OSTI; NTIS; INIS; GPO Dep.

The Tank Waste Remediation System (TWRS) pretreatment facility project W-236B, known as the Initial Pretreatment Module (IPM), requires samples of supernatants and sludges from 200 Area tank farms for planned hot testing work in support of IPM design. The IPM project has proposed the development of several new sampler systems. These systems include a 0.5-l supernatant sampler, 3-l and 25-l supernatant and sludge samplers, and a 4,000-l sampler system. The 0.5-l sampler will support IPM sampling needs in the 1 to 3 l range starting in late fiscal year 1995. This sampler is intended to be used in conjunction with the existing 100 ml bottle-on-a-string. The 3-l and 25-l systems will be based on the Savannah River Site's sampler system and will support IPM sampling needs in the 3 to 100 liter range. Most of the hot testing required for design of the IPM must be accomplished in the next 3 years. This work plan defines the tasks associated with the development of a 0.5-l sampler system. This system will be referred to as the Half-Liter Supernatant Sampler System (HLSSS). Specifically, this work plan will define the scope of work, identify organizational responsibilities, identify major technical requirements, describe configuration control and verification requirements, and provide estimated costs and schedule. The sampler system will be fully operational, including trained staff and operating procedures, upon completion of this task.

23314 (WHC-SP–1156) **Mid-year report: IPC liaison and chemistry of thermal reconstitution.** Delegard, C.H. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013513. Source: OSTI; NTIS; INIS; GPO Dep.

A program of investigation into the chemistry of alkaline Hanford Site tank waste is being conducted. The investigations have two main subtasks: liaison with the Institute of Physical Chemistry of the Russian Academy of Sciences and further laboratory testing of the chemistry of thermal reconstitution of Hanford Site tank waste. Progress to date includes: (1) a technical dialogue has been established with the Institute scientists; (2) editing of a technical literature review on the chemistry of the transuranic elements and technetium in alkaline media written by researchers at the Institute is complete; (3) four tasks from the Institute have been selected for support by the US Department of Energy; (4) technical information has been supplied to the Institute describing the composition of Hanford Site tank waste; (5) tests, using genuine waste from tank 104-S (a REDOX Process sludge), comparing the performance of thermal reconstitution with enhanced sludge washing show markedly improved dissolution of aluminum achieved by the thermal treatment; (6) a reduction/coprecipitation method was tested and shown to remove plutonium, solubilized by thermal treatment, rapidly and efficiently from solution; (7) technical chemistry support was provided to calciner kinetics tests at the University of Idaho; (8) tests to determine the speciation of plutonium and neptunium solubilized by thermal treatment show dissolved Pu(V) and Np(V) hydroxide complexes are produced, a Np(V) peroxide complex also was identified; (9) recently published data on Pu(IV) carbonate complexation in moderately alkaline (pH 12 to 13) solution led to reexamination of previous investigations of plutonium complexation in highly alkaline (3 to 5 molar NaOH) solutions.

0530 Environmental Aspects

Refer also to citation(s) 23163, 23185, 23188, 23189, 23190, 23191, 23198, 23207, 23338, 23341, 23361, 23368, 23826, 23930, 24610, 24612

23315 (ANL/DIS/CP–85160) **Applying automated data acquisition and management technology to bioremediation.** Widing, M.A.; Leser, C. Argonne National Lab., IL (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505101–2: Conference on challenges and innovations in the management of hazardous waste, Washington, DC (United States), 10-12 May 1995). Order Number DE95013370. Source: OSTI; NTIS; GPO Dep.

Operating a bioremediation process requires timely and accurate analysis of physical and chemical parameters that can affect the system. At a fuel oil spill site, the operation of an in-situ bioremediation system, consisting of fluid and nutrient injection, fluid withdrawal, and aeration cycles, is monitored by means of electronic downhole sensors and on-site chemical analysis. A data acquisition and management system was designed and implemented to rapidly analyze data for operational decision malting. A hardware suite, containing an electronic monitoring system data acquisition computer, and data analysis workstation, was also developed. Through the use of both commercial software products and custom software, suites of data management and analysis tools were provided. The data acquisition suite of software tools assisted in programming dataloggers, automatically recording monitored data, and integrating these data with manually sampled chemical data. The data analysis suite of software tools assisted in downloading data to remote workstations, sampling the database for trend analysis, and automating the interface to commercial analysis packages.

23316 (CONF-9504123–2) **Biological tracer for waste site characterization.** Strong-Gunderson, J. Oak Ridge National Lab.,

TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Innovative concepts technology and business opportunities; Denver, CO (United States); 20-21 Apr 1995. Order Number DE95014598. Source: OSTI; NTIS; INIS; GPO Dep.

Remediating hazardous waste sites requires detailed site characterization. In groundwater remediation, characterizing the flow paths and velocity is a major objective. Various tracers have been used for measuring groundwater velocity and transport of contaminants, colloidal particles, and bacteria and nutrients. The conventional techniques use dissolved solutes, dyes. and gases to estimate subsurface transport pathways. These tracers can provide information on transport and diffusion into the matrix, but their estimates for groundwater flow through fractured regions are very conservative. Also, they do not have the same transport characteristics as bacteria and suspended colloid tracers, both of which must be characterized for effective in-place remediation. Bioremediation requires understanding bacterial transport and nutrient distribution throughout the acquifer, knowledge of contaminants s mobile colloidal particles is just essential.

23317 (DOE/AL/62350–171) **UMTRA Project-Level Cost Reduction/Productivity Improvement Program manual.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jun 1995. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95016204. Source: OSTI; NTIS; INIS; GPO Dep.

Mission of the Uranium Mill Tailings Remedial Action (UMTRA) Project Cost Reduction/Productivity Improvement Program (CR/PIP) is to contribute to the UMTRA Project's environmental restoration mission by providing the means to achieve and recognize continuous improvements and cost savings. This manual includes program definition, description of UMTRA project organizational responsibilities and interfaces with existing project functions, guidance to contractors, and definition of project-level functions.

23318 (DOE/AL/62350–191) **Report of ground water monitoring for expansion of the golf course, Salt Lake City, Utah, vitro processing site.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jun 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95013501. Source: OSTI; NTIS; INIS; GPO Dep.

To determine the potential impacts of the proposed golf course expansion on the south side of the Vitro site, ground water data from the UMTRA Vitro processing site were evaluated in response to the U.S. Department of Energy (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project Office request. Golf in the Round, Inc., has proposed an expansion of the present driving range to include a 9-hole golf course on the UMTRA Vitro processing site, which is owned by the Central Valley Water Reclamation Facility (CVWRF). An expanded golf course would increase irrigation and increase the amount of water that could infiltrate the soil, recharging the unconfined aquifer. Increased water levels in the aquifer could alter the ground water flow regime; contaminants in the shallow ground water could then migrate off the site or discharge to surface water in the area. Dewatering of the unconfined aquifer on CVWRF property could also impact site contaminant migration; a significant amount of ground water extraction at CVWRF could reduce the amount of contaminant migration off the site. Since 1978, data have been collected at the site to determine the distribution of tailings materials (removed from the site from 1985 to 1987) and to characterize the presence and migration of contaminants in sediments, soils, surface water, and ground water at the former Vitro processing site. Available data suggest that irrigating an expanded golf course may cause contamination to spread more rapidly within the unconfined aquifer. The public is not at risk from current Vitro processing site activities, nor is risk expected due to golf course expansion. However, ecological risk could increase with increased surface water contamination and the development of ground water seeps.

23319 (DOE/CAO–2056-Vol.6-Draft) **Draft Title 40 CFR 191 compliance certification application for the Waste Isolation Pilot Plant. Volume 6: Appendix GCR Volume 1.** USDOE Carlsbad Area Office, NM (United States); Sandia Labs., Albuquerque, NM (United States). 31 Mar 1995. 556p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (SAND–78-1596-Vol.1). Order Number DE95012435. Source: OSTI; NTIS; INIS; GPO Dep.

The Geological Characterization Report (GCR) for the WIPP site presents, in one document, a compilation of geologic information available to August, 1978, which is judged to be relevant to studies for the WIPP. The Geological Characterization Report for the WIPP site is neither a preliminary safety analysis report nor an environmental impact statement; these documents, when prepared, should be consulted for appropriate discussion of safety analysis and environmental impact. The Geological Characterization Report of the WIPP site is a unique document and at this time is not required by regulatory process. An overview is presented of the purpose of the WIPP, the purpose of the Geological Characterization Report, the site selection criteria, the events leading to studies in New Mexico, status of studies, and the techniques employed during geological characterization.

23320 (DOE/CAO–2056-Vol.7-Draft) **Draft Title 40 CFR 191 compliance certification application for the Waste Isolation Pilot Plant. Volume 7: Appendix GCR Volume 2.** USDOE Carlsbad Area Office, NM (United States); Sandia Labs., Albuquerque, NM (United States). 31 Mar 1995. 725p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (SAND–78-1596-Vol.2). Order Number DE95012752. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains the second part of the geological characterization report for the Waste Isolation Pilot Plant. Both hydrology and geochemistry are evaluated. The following aspects of hydrology are discussed: surface hydrology; ground water hydrology; and hydrology drilling and testing. Hydrologic studies at the site and adjacent site areas have concentrated on defining the hydrogeology and associated salt dissolution phenomena. The geochemical aspects include a description of chemical properties of geologic media presently found in the surface and subsurface environments of southeastern New Mexico in general, and of the proposed WIPP withdrawal area in particular. The characterization does not consider any aspect of artificially-introduced material, temperature, pressure, or any other physico-chemical condition not native to the rocks of southeastern New Mexico.

23321 (DOE/CAO–2056-Vol.8-Draft) **Draft Title 40 CFR 191 compliance certification application for the Waste Isolation Pilot Plant. Volume 8: Appendices HYDRO, IRD, LTM, NUTS, PAR, PMR, QAPD, RBP.** USDOE Carlsbad Area Office, NM (United States); Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. 31 Mar 1995. 619p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE95012753. Source: OSTI; NTIS; INIS; GPO Dep.

Geohydrologic data have been collected in the Los Medanos area at the US Department of Energy's proposed Waste Isolation Pilot Plant (WIPP) site in southeastern New Mexico since 1975 as part of a study evaluating the feasibility of storing defense-associated nuclear wastes within the bedded salt of the Salado Formation of Permian age. Drilling and hydrologic testing have identified three principal water-bearing zones above the Salado Formation and one below that could potentially transport wastes to the biosphere if the proposed facility were breached. The zones above the Salado are the contact between the Rustler and Salado Formations and the Culebra and Magenta Dolomite Members of the Rustler Formation of Permian age. The zone below the Salado Formation consists of channel sandstones in the Bell Canyon Formation of the Permian Delaware Mountain Group. Determinations of hydraulic gradients, directions of flow, and hydraulic properties were hindered because of the negligible permeability of the water-bearing zones. Special techniques in drilling, well completion, and hydraulic testing have been developed to determine the hydrologic characteristics of these water-producing zones.

23322 (DOE/CAO–2056-Vol.9-Draft) **Draft Title 40 CFR 191 compliance certification application for the Waste Isolation Pilot Plant. Volume 9: Appendices RM, SCR, SER, SUM, WRAC.** USDOE Carlsbad Area Office, NM (United States); Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div.

31 Mar 1995. 580p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE95012755. Source: OSTI; NTIS; INIS; GPO Dep.

The Rock Mechanics Program is important to the establishment of a radioactive waste repository in salt because rock mechanics deals with the prediction of creep closure and eventual encapsulation of the waste. The intent of this paper is to give the current status of the program. This program consists of three major modeling efforts: continuum creep, fracture, and the disturbed rock zone. These models, together with laboratory material parameters, plastic flow potentials, initial and boundary input data, and other peripheral information forms the predictive technology. The extent to which the predictive technology is validated against in situ test data adds certainty to the method. Application of the technology is through simulations of the test results, design, or performance using numerical codes. In summary, the predictive capabilities are technically sound and reasonable. The current status of the program is that which would be advanced for compliance.

23323 (DOE/EA–1030) **Characterization of stored defense production spent nuicear fuel and associated materials at Hanford Site, Richland Washington: Environmental assessment.** USDOE, Washington, DC (United States). Mar 1995. 62p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012247. Source: OSTI; NTIS; INIS; GPO Dep.

There are about 2,100 tonnes (2,300 tons) of defense production spent nuclear fuel stored in the 100-K Area Basins located along the south shore of the Columbia River in the northern part of the Hanford Site. Some of the fuel which has been in storage for a number of years is in poor condition and continues to deteriorate. The basins also contain fuel fragments and radioactively contaminated sludge. The DOE needs to characterize defense production spent nuclear fuel and associated materials stored on the Hanford Site. In order to satisfy that need, the Department of Energy (DOE) proposes to select, collect and transport samples of spent nuclear fuel and associated materials to the 327 Building for characterization. As a result of that characterization, modes of interim storage can be determined that would be compatible with the material in its present state and alternative treatment processes could be developed to permit a broader selection of storage modes. Environmental impacts of the proposed action were determined to be limited principally to radiation exposure of workers, which, however, were found to be small. No health effects among workers or the general public would be expected under routine operations. Implementation of the proposed action would not result in any impacts on cultural resources, threatened, endangered and candidate species, air or water quality, socioeconomic conditions, or waste management.

23324 (DOE/EIS–0203-F-Vol.1-App.L) **Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs. Final Environmental Impact Statement: Volume 1, Appendix L, Environmental Justice.** USDOE Idaho Operations Office, Idaho Falls, ID (United States). Apr 1995. 46p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012042. Source: OSTI; NTIS; INIS; GPO Dep.

Appendix L provides an assessment of the areas surrounding the 10 sites under consideration for the management of spent nuclear fuels (SNF) under all programmatic alternatives considered in this volume. It is divided into two sections: (a) the five sites considered for the management of DOE naval SNF only (under the No Action and Decentralization alternatives, and (b) the five DOE sites being considered for the management of all types of DOE SNF under all alternatives. The five sites considered for the management of naval SNF only are the Norfolk Naval Shipyard, Portsmouth, Virginia; Portsmouth Naval Shipyard, Kittery, Maine; Pearl Harbor Naval Shipyard, Honolulu, Hawaii; Puget Sound Naval Shipyard, Bremerton, Washington; and Kesselring Site, West Milton, New York. The five DOE sites considered for the management of some portion or all DOE SNF are the Savannah River Site, Aiken, South Carolina; Oak Ridge Reservation, Oak Ridge, Tennessee; Idaho National Engineering Laboratory, Idaho Falls, Idaho; Hanford Site, Richland, Washington; and Nevada Test Site, Mercury, Nevada. This assessment includes potential adverse impacts resulting from both onsite activities and associated transportation of materials. Based on this assessment, it is concluded that none of the alternatives analyzed results in disproportionately high and adverse effects on minority populations or low-income communities surrounding any of the sites under consideration for the management of SNF or associated offsite transportation routes.

23325 (DOE/EIS–0226) **Implementation plan for the Environmental Impact Statement for completion of the West Valley Demonstration Project by the US Department of Energy and closure of the western New York Nuclear Service Center, The New York State Energy Research and Development Authority. Revision 7.** USDOE, Washington, DC (United States); New York State Energy Research and Development Authority, Albany, NY (United States); USDOE West Valley Area Office, NY (United States). Mar 1995. 108p. Sponsored by USDOE, Washington, DC (United States);New York State Government, Albany, NY (United States);Nuclear Regulatory Commission, Washington, DC (United States). Order Number DE95012245. Source: OSTI; NTIS; INIS; GPO Dep.

The primary purpose of the EIS Implementation Plan (IP) is to record the results of the scoping process and to provide guidance to the DOE for the preparation of an EIS (10 CFR 1021). In order to provide such guidance, this IP identifies the purpose and need for agency action (Section 2.0); summarizes the results of the scoping process (Section 3.0); identifies and describes cleanup and closure alternatives (Section 4.0); identifies significant environmental issues (Section 5.0); discusses the environmental impact statement preparation issues (Section 6.0); and presents a detailed outline of the draft EIS in Appendix E. The IP also identifies certain issues that are not within the scope of the EIS.

23326 (DOE/RW/00134–T18) **Nevada potential repository preliminary transportation strategy: Study 1.** TRW Environmental Safety Systems, Inc., Las Vegas, NV (United States). Apr 1995. 169p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-91RW00134. Order Number DE95013302. Source: OSTI; NTIS; INIS; GPO Dep.

Limited feasible options exist when considering the shipment of spent nuclear fuel and high-level radioactive waste. These options are rail or truck; because of the weight associated with transportation casks (68.0 to 113.4 tonnes/75 to 125 tons), heavy-haul trucks are also considered. Yucca Mountain currently lacks rail service or an existing right-of-way for rail; it also lacks a dedicated highway suitable for heavy-haul trucks. Approximately 11,230 shipments by rail are planned from waste producer sites to Nevada, with an additional 1,041 shipments by legal-weight truck from four reactor sites not capable of upgrading for rail shipment. This study identifies the reasonable alternatives for waste transport to the potential repository site, describes the evaluation process performed to identify those alternatives, and discusses the reasons for elimination of transportation routes deemed to be not reasonable. The study concluded that heavy haul truck transportation is feasible-cost is very favorable when compared to rail-but route restrictions must be further evaluated. In addition to restrictions due to seasonal weather conditions, specific routes have additional restrictions, including no travel on holidays or weekends, and travel during daylight hours only. Further restrictions will be imposed by the U.S. Department of Transportation based on routing of radioactive materials by highway. Operation and maintenance costs for heavy-haul over a 24-year period, based on preliminary information, were calculated on an estimated operational cost of $15,000 per trip, with an estimated 468 trips per year average (11,230 total trips), for an estimated cost of $171 million to $173 million, depending on the route used. Because the initial costs and the total system life cycle costs of heavy-haul are approximately 50 percent lower than the lowest rail cost, this option will continue to be evaluated.

23327 (DOE/RW–95014715) **Site environmental report for calendar year 1994, Yucca Mountain Site, Nye County, Nevada.** USDOE Yucca Mountain Site Characterization Project Office, Las Vegas, NV (United States). Jun 1995. 117p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014715. Source: OSTI; NTIS; INIS; GPO Dep.

The Yucca Mountain Site Characterization office has established an environmental program to ensure that facilities are operated in

order to protect, maintain, and restore environmental quality, minimize potential threats to the environment and the public, and comply with environmental policies and US DOE orders. The status of the environmental program has been summarized in this annual report to characterize performance, confirm compliance with environmental requirements, and highlight significant programs and efforts during CY 1994. Monitoring, archaeology, groundwater, ecosystems, tortoise conservation, waste minimization, etc., are covered.

23328 (LA–12967-MS) **Ecological surveys of the proposed high explosives wastewater treatment facility region.** Haarmann, T. Los Alamos National Lab., NM (United States). Jul 1995. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015053. Source: OSTI; NTIS; INIS; GPO Dep.

Los Alamos National Laboratory (LANL) proposes to improve its treatment of wastewater from high explosives (HE) research and development activities. The proposed project would focus on a concerted waste minimization effort to greatly reduce the amount of wastewater needing treatment. The result would be a 99% decrease in the HE wastewater volume, from the current level of 6,760,000 L/mo (1,786,000 gal./mo) to 41,200 L/mo (11,000 gal./mo). This reduction would entail closure of HE wastewater outfalls, affecting some wetland areas that depend on HE wastewater effluents. The outfalls also provide drinking water for many wildlife species. Terminating the flow of effluents at outfalls would represent an improvement in water quality in the LANL region but locally could have a negative effect on some wetlands and wildlife species. None of the affected species are protected by any state or federal endangered species laws. The purpose of this report is to briefly discuss the different biological studies that have been done in the region of the project area. This report is written to give biological information and baseline data and the biota of the project area.

23329 (LA-SUB–95-72) **The modification and application of RAMS computer code. Final report.** McKee, T.B. (Colorado State Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science). Los Alamos National Lab., NM (United States); Colorado State Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science. 17 Jan 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95014570. Source: OSTI; NTIS; INIS; GPO Dep.

The Regional Atmospheric Modeling System (RAMS) has been utilized in its most updated form, version 3a, to simulate a case night from the Atmospheric Studies in COmplex Terrain (ASCOT) experimental program. ASCOT held a wintertime observational campaign during February, 1991 to observe the often strong drainage flows which form on the Great Plains and in the canyons embedded within the slope from the Continental Divide to the Great Plains. A high resolution (500 m grid spacing) simulation of the 4-5 February 1991 case night using the more advanced turbulence closure now available in RAMS 3a allowed greater analysis of the physical processes governing the drainage flows. It is found that shear interaction above and within the drainage flow are important, and are overpredicted with the new scheme at small grid spacing (< ~1000 m). The implication is that contaminants trapped in nighttime stable flows such as these, will be mixed too strongly in the vertical reducing predicted ground concentrations. The HYPACT code has been added to the capability at LANL, although due to the reduced scope of work, no simulations with HYPACT were performed.

23330 (LA-UR–95-1342) **LRAD surface monitoring results at TA-21.** Bounds, J.A. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95014014. Source: OSTI; NTIS; INIS; GPO Dep.

In August/September 1994, NIS-6 personnel used LRAD soil surface monitor technology to characterize the extent of alpha contamination on the surface of a parking lot adjacent to TA-21, LANL, known as Material Disposal Area B. This report documents that monitoring. Based on this survey, there is no reason for concern about significant contamination in the parking area as a whole, although unexpected small hot spots could exist between the grid points where monitoring was performed. However, the grouping of high readings on the east side of the parking area does point to possible contamination at the level of 100 dpm/100 cm^2 or less (above background). Further monitoring or remediation of this area seems appropriate. In addition, because this was an alpha survey, one cannot rule out contamination under the asphalt or possibly between layers if it was paved more than once.

23331 (PNL-SA–26209) **The development and usage of a new chemical transport code: AREST-CT.** Engel, D.W.; Chen, Yueting; Fort, J.A.; McGrail, B.P.; Steefel, C.I. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9504179–2: 6. annual international conference on high level radioactive waste management, Las Vegas, NV (United States), 30 Apr - 5 may 1995). Order Number DE95014620. Source: OSTI; NTIS; INIS; GPO Dep.

We are developing a computer code for DOE, called the Analyzer for REpository Source Term with Chemical Transport (AREST-CT), as a waste package computer model to analyze the performance of the potential site for the repository at Yucca Mountain, Nevada. This report briefly describes the AREST-CT development and an example showing the use of the coupled chemical-transport model.

23332 (SAND–94-2585) **Creep in Topopah Spring Member welded tuff. Yucca Mountain Site Characterization Project.** Martin, R.J. III (New England Research, Inc., White River Junction, VT (United States)); Boyd, P.J.; Noel, J.S.; Price, R.H. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014138. Source: OSTI; NTIS; INIS; GPO Dep.

A laboratory investigation has been carried out to determine the effects of elevated temperature and stress on the creep deformation of welded tuffs recovered from Busted Butte in the vicinity of Yucca Mountain, Nevada. Water saturated specimens of tuff from thermal/mechanical unit TSw2 were tested in creep at a confining pressure of 5.0 MPa, a pore pressure of 4.5 MPa, and temperatures of 25 and 250 C. At each stress level the load was held constant for a minimum of 2.5×10^5 seconds and for as long as 1.8×10^6 seconds. One specimen was tested at a single stress of 80 MPa and a temperature of 250 C. The sample failed after a short time. Subsequent experiments were initiated with an initial differential stress of 50 or 60 MPa; the stress was then increased in 10 MPa increments until failure. The data showed that creep deformation occurred in the form of time-dependent axial and radial strains, particularly beyond 90% of the unconfined, quasi-static fracture strength. There was little dilatancy associated with the deformation of the welded tuff at stresses below 90% of the fracture strength. Insufficient data have been collected in this preliminary study to determine the relationship between temperature, stress, creep deformation to failure, and total failure time at a fixed creep stress.

23333 (WHC-EP–0857) **Statement of work for analytical services provided to Westinghouse Hanford Company by the Pacific Northwest Laboratory Analytical Chemistry Laboratory.** Perry, J.K. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012822. Source: OSTI; NTIS; INIS; GPO Dep.

This statement of work establishes the laboratory analytical criteria and requirements for the fiscal year 1995 radioactive airborne emissions measurement program for the Hanford Site.

23334 (WHC-SD-EN-AP–185) **Groundwater monitoring plan for the 300 Area process trenches.** Lindberg, J.W.; Chou, C.J.; Johnson, V.G. Westinghouse Hanford Co., Richland, WA (United States). 23 May 1995. 162p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013880. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the groundwater monitoring program for the Hanford Site 300 Area Process Trenches (300 APT). The 300 APT are a Resource Conservation and Recovery Act of 1976 (RCRA) regulated unit. The 300 APT are included in the Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste, Permit No. WA890008967, and are subject to final-status

requirements for groundwater monitoring. This document describes a compliance monitoring program for groundwater in the uppermost aquifer system at the 300 APT. This plan describes the 300 APT monitoring network, constituent list, sampling schedule, statistical methods, and sampling and analysis protocols that will be employed for the 300 APT. This plan will be used to meet groundwater monitoring requirements from the time the 300 APT becomes part of the Permit and through the postclosure care period until certification of final closure.

23335 (WSRC-TR–94-0543-Rev.1) **Quarterly sampling of the wetlands along the old F-Area effluent ditch: August 1994. Revision 1.** Cummins, C.L.; Dixon, K.L. Westinghouse Savannah River Co., Aiken, SC (United States). Aug 1994. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95015191. Source: OSTI; NTIS; INIS; GPO Dep.

In August 1994, well point water and near-surface water samples were collected to further characterize tritium and volatile organic compounds in the Wetlands along the old F-Area effluent ditch south of 643-E at the Savannah River Plant. Well point samples were collected from seven locations and near-surface water samples were collected at four locations. Results of the August 1994 sampling event further support findings that tritium and volatile organic compounds are outcropping in the Wetlands near the old F-area effluent ditch. Four analytes (1,2-dichloroethylene, trichloroethylene, tritium, and vinyl chloride) were detected at least once at concentrations above the primary Drinking Water Standards or the Maximum Contaminant Levels. Five analytes (the above chemicals plus tetrachloroethylene) were detected at least once in the near-surface water samples at concentrations greater than the method detection limit.

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Refer also to citation(s) 23136, 23151, 23159, 23166, 23168, 23177, 23182, 23183, 23184, 23215, 23219, 23225, 23227, 23269, 23274, 23281, 23282, 23283, 23284, 23285, 23286, 23289, 23297, 23307, 23313, 23394, 23410, 23704, 23716, 23723, 23984, 23992, 24016, 24444, 24567, 24568, 24579, 24591, 24604, 24724, 24947

23336 (ANL/DIS/CP–84269) **Development and use of consolidated criteria for evaluation of emergency preparedness plans for DOE facilities.** Lerner, K.; Kier, P.H.; Baldwin, T.E. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950430–9: 5. ANS topical meeting on emergency preparedness and response, Savannah, GA (United States), 18-21 Apr 1995). Order Number DE95013684. Source: OSTI; NTIS; INIS; GPO Dep.

Emergency preparedness at US Department of Energy (DOE) facilities is promoted by development and quality control of response plans. To promote quality control efforts, DOE has developed a review document that consolidates requirements and guidance pertaining to emergency response planning from various DOE and regulatory sources. The Criteria for Evaluation of Operational Emergency Plans (herein referred to as the Criteria document) has been constructed and arranged to maximize ease of use in reviewing DOE response plans. Although developed as a review instrument, the document also serves as a de facto guide for plan development, and could potentially be useful outside the scope of its original intended DOE clientele. As regulatory and DOE requirements are revised and added in the future, the document will be updated to stay current.

23337 (ANL/ES/CP–85247) **Ultrasonic process for remediation of organics-contaminated groundwater/wastewater.** Wu, J.M.; Peters, R.W. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505217–3: Air & Waste Management Association Policy meeting, Washington, DC (United States), 10-12 May 1995). Order Number DE95013690. Source: OSTI; NTIS; INIS; GPO Dep.

A technology is being developed that employs ultrasonic-wave energy for remediation of groundwater/wastewater contaminated with volatile organic compounds such as carbon tetrachloride (CCl_4) and trichloroethylene (TCE). This paper presents the updated results of a laboratory investigation of ultrasonic groundwater remediation using synthetic groundwaters prepared with laboratory deionized water. Key process parameters investigated included steady-state temperature, contaminant concentration, solution pH, sonication time, and intensity of the applied ultrasonics-wave energy. High destruction efficiencies of the target contaminants were achieved, and the sonication time required for a given degree of destruction decreased with increasing intensity of the applied ultrasonic energy. The sonication time can be further reduced by adding a chemical oxidant such as hydrogen peroxide.

23338 (ANL/ES/CP–86536) **Plutonium mobility studies in soil sediment decontaminated by means of a soil-washing technology.** Negri, M.C. (Argonne National Lab., IL (United States)); Orlandini, K.A.; Swift, N.; Carfagno, D. Argonne National Lab., IL (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505101–7: Conference on challenges and innovations in the management of hazardous waste, Washington, DC (United States), 10-12 May 1995). Order Number DE95013719. Source: OSTI; NTIS; INIS; GPO Dep.

The ACT*DE*CON^{SM} process extracts plutonium from contaminated soils/sediments by means of a series of washings with a blend of chemicals, that includes a chelating agent, an oxidant, and carbonates. At the end of the process, the Pu level in the soil is lowered to 25-30 pCi/g from an initial contamination level averaging 500 pCi/g. The radionuclide still present in the soil at the end of the treatment must be strongly immobilized in or onto the soil particles to minimize the risk of its percolation to the aquifer and/or uptake by vegetation. This paper reports the investigation of residual Pu mobility as K_d (distribution coefficient) in the treated soil/sediment. Six batches of contaminated soil were treated simultaneously by means of the ACT*DE*CON^{SM} process. Some batches of the treated soil were amended with a standard fertilizer treatment of compost and nutrient and brought to pH 8.5. The treated soil, treated and fertilized soil, and the untreated controls were then incubated at 18°C for 90 days. At four different times, a small aliquot of soil was retrieved from each of the batches and contacted with rainwater for six days to determine the Pu solid/liquid distribution and K_d. Results indicated that a higher total amount of Pu was leached from the untreated soil, probably as a consequence of the higher content of available/exchangeable Pu in this soil compared with the treated ones. Treated/fertilized soils showed Pu leaching at intermediate levels between those for treated and untreated soils, at least for the first 30 days of incubation. K_d values at the beginning of the incubation period were significantly lower in the untreated and treated/fertilized soils compared with those for the treated-only, but at 90 days, these values were substantially equal among the three different soils. Traces of the chelant were detectable only in treated, unfertilized soil.

23339 (ANL/RE/CP–85754) **Seismic evaluation of a hot cell structure.** Srinivasan, M.G.; Kot, C.A. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950740–60: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95014239. Source: OSTI; NTIS; INIS; GPO Dep.

The evaluation of the structural capacity of and the seismic demand on an existing hot cell structure in a nuclear facility is described. An ANSYS finite-element model of the cell was constructed, treating the walls as plates and the floor and ceiling as a system of discrete beams. A modal analysis showed that the fundamental frequencies of the cell walls lie far above the earthquake frequency range. An equivalent static analysis of the structure was performed. Based on the analysis it was demonstrated that the hot cell structure, would readily withstand the evaluation basis earthquake.

23340 (DOE/AL/62350–157-Rev.) **Site observational work plan for the UMTRA Project site at Falls City, Texas.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jun 1995. 300p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC04-91AL62350. Order Number DE95015575. Source: OSTI; NTIS; INIS; GPO Dep.

Produced by the US Department of Energy (DOE), this site observational work plan (SOWP) will be used to determine site-specific activities to comply with the US Environmental Protection Agency (EPA) ground water standards at this Uranium Mill Tailings Remedial Action (UMTRA) Project site. The purpose of the SOWP is to recommend a site-specific ground water compliance strategy at the Falls City UMTRA Project site. The Falls City SOWP presents a comprehensive summary of site hydrogeological data, delineates a conceptual model of the aquifer system, and discusses the origins of milling-related ground water contamination. It also defines the magnitude of ground water contamination, potential environmental and health risks associated with ground water contamination and data gaps, and targets a proposed compliance strategy.

23341 (DOE/AL/62350–179) **Baseline risk assessment of ground water contamination at the Uranium Mill Tailings Sites near Rifle, Colorado.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). May 1995. 252p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95013503. Source: OSTI; NTIS; INIS; GPO Dep.

The ground water project evaluates the nature and extent of ground water contamination resulting from the uranium ore processing activities. This report is a site specific document that will be used to evaluate current and future impacts to the public and the environment from exposure to contaminated ground water. Currently, no one is using the ground water and therefore, no one is at risk. However, the land will probably be developed in the future and so the possibility of people using the ground water does exist. This report examines the future possibility of health hazards resulting from the ingestion of contaminated drinking water, skin contact, fish ingestion, or contact with surface waters and sediments.

23342 (DOE/AL/62350–188) **Final audit report of remedial action construction at the UMTRA Project Falls City, Texas, site.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). May 1995. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95013502. Source: OSTI; NTIS; INIS; GPO Dep.

This final audit report for the Falls City, Texas, Uranium Mill Tailings Remedial Action Project site summarizes the radiological audits and the quality assurance (QA) in-process surveillances, audits, and final close-out inspection performed by the U.S. Department of Energy (DOE) and Technical Assistance Contractor (TAC). It also summarizes U.S. Nuclear Regulatory Commission (NRC) surveillances. One radiological audit and three radiological surveillances were performed at the Falls City site. These surveillances and audit, which resulted in 31 observations, focused primarily on processing site activities and were performed on the following dates: 3-6 August 1992, 29-30 October 1992, 22-26 March 1993, and 1-3 November 1993. All outstanding radiological issues were closed out at the completion of the construction activities. Six QA in-process surveillances, which resulted in 71 observations, were performed at the Falls City site on the following dates: 22-24 July 1992, 23-25 November 1992, 17-19 May 1993, 16-18 August 1993, 13-15 October 1993, and 2-4 February 1994. All outstanding issues were closed out with the February surveillance on 3 March 1994. The DOE/TAC remedial action close-out inspections of the Falls City site, which resulted in 56 observations, were conducted 9-10 June 1994 and 26 July 1994. The inspections were closed out on 26 January 1995. The NRC performed three on-site construction reviews (OSCR), resulting in seven observations of remedial action construction activities that occurred during site visits. The OSCRs were performed 9 December 1992, 12 May 1993, and 25 October 1993. Since all audit and surveillance observations and recommendations have been closed out, this final audit report segment of the site certification process is complete.

23343 (DOE/CAO–2056-Vol.5-Draft) **Draft Title 40 CFR 191 compliance certification application for the Waste Isolation Pilot Plant. Volume 5: Appendices D and D, DEF, FAC.** USDOE Carlsbad Area Office, NM (United States); Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. 31 Mar 1995. 529p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (DOE/WIPP–95-2072). Order Number DE95012434. Source: OSTI; NTIS; INIS; GPO Dep.

This plan serves to describe the objectives of decommissioning for the Waste Isolation Pilot Plant (WIPP), identifies the elements necessary to accomplish the decommissioning, and defines the steps to execute those elements in a safe and environmentally sound manner. The plan provides a strategy for progressing from the final actions of the Disposal Phase, through the Decontamination and Decommissioning Phase, and into the initiation of the Long-Term Monitoring Phase. This plan describes a sequence of events for decontamination of the WIPP facilities and structures used to manage and contain TRU and TRU mixed waste during the receipt and emplacement operations. Alternative methods of decontamination are provided where practical. The methods for packaging and disposal of the waste generated (derived waste) during this process are discussed. The best available technology at the time of this plan's development, may become outmoded by future technology and alternative strategies. If alternative technologies are identified the affected stakeholder(s), the Secretary of the Interior and the State will be consulted prior to implementation.

23344 (DOE/EA–0683) **Environmental assessment for Mound Plant decontamination and decommissioning projects, Mound Plant, Miamisburg, Ohio.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). May 1995. 54p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014000. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy (DOE) has prepared an Environmental Assessment (EA) for seven decontamination and decommissioning (D&D) projects at the Mound Plant in Miamisburg, Ohio, that have not been previously addressed in the Final Environmental Impact Statement for the Mound Facility (June 1979). Based on the information presented in the EA, the DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an Environmental Impact Statement (EIS) is not required and the Department is issuing this Finding of No Significant Impact (FONSI).

23345 (DOE/EH–0497) **Department of Energy Voluntary Protection Program - Part IV: Onsite review handbook.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Jul 1995. 108p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015935. Source: OSTI; NTIS; GPO Dep.

Onsite Review Handbook contains criteria to be used in evaluating the management systems required for initial or continued participation in the Department of Energy Voluntary Protection Program (DOE-VPP), verifying and calculating rates of injury experience, the Onsite Review report format, and sample questions to be used during onsite interviews. This document should be used in conjunction with the first three DOE-VPP manuals (Part I: Program Elements, Part II: Procedures Manual, and Part III: Application Guidelines). This document is intended to assist Onsite Review team members and DOE contractors in evaluating safety and health programs, and to serve as guidance for DOE-VPP participants in performing their required annual evaluation. Requests for additional information or any questions may be addressed to a DOE-VPP Coordinator in the Office of Occupational Safety and Health Policy. The term contractor used throughout this document refers to an applicant to, or a participant in, the DOE-VPP. The term subcontractor refers to any organization that is contracted by the applicant or participant to do work at the site under review. The DOE-VPP Onsite Review Criteria contained in Appendix A provide guidance for evaluating a site's implementation of the program requirements given in Part I: Program Elements. The program requirements are in bold italicized type, followed by guidance for ensuring implementation. Part I should be consulted for a complete description of the program requirements. These criteria should be used by team members whenever possible, but are not intended to be all inclusive. Determination of adequate implementation of the

DOE-VPP requirements is at the team members' discretion. Guidance for calculating recordable injury and lost workday incidence rates is contained in Appendix B. The OSHA injury/illness records review and the associated calculations should be performed by On-site Review Team members during the pre-onsite planning visit.

23346 (DOE/EM–0250) **Robotics Technology Crosscutting Program. Technology summary.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Jun 1995. 114p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016130. Source: OSTI; NTIS; INIS; GPO Dep.

The Robotics Technology Development Program (RTDP) is a needs-driven effort. A length series of presentations and discussions at DOE sites considered critical to DOE's Environmental Restoration and Waste Management (EM) Programs resulted in a clear understanding of needed robotics applications toward resolving definitive problems at the sites. A detailed analysis of the resulting robotics needs assessment revealed several common threads running through the sites: Tank Waste Retrieval (TWR), Contaminant Analysis Automation (CAA), Mixed Waste Operations (MWO), and Decontamination and Dismantlement (D and D). The RTDP Group also realized that some of the technology development in these four areas had common (Cross Cutting-CC) needs, for example, computer control and sensor interface protocols. Further, the OTD approach to the Research, Development, Demonstration, Testing, and Evaluation (RDDT and E) process urged an additional organizational breakdown between short-term (1–3 years) and long-term (3–5 years) efforts (Advanced Technology-AT). These factors lead to the formation of the fifth application area for Crosscutting and Advanced Technology (CC and AT) development. The RTDP is thus organized around these application areas – TWR, CAA, MWO, D and D, and CC and AT – with the first four developing short-term applied robotics. An RTDP Five-Year Plan was developed for organizing the Program to meet the needs in these application areas.

23347 (DOE/EM–0252) **Mixed waste characterization, treatment, and disposal focus area. Technology summary.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Jun 1995. 116p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016003. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents details about the technology development programs of the Department of Energy. In this document, waste characterization, thermal treatment processes, non-thermal treatment processes, effluent monitors and controls, development of on-site innovative technologies, and DOE business opportunities are applied to environmental restoration. The focus areas for research are: contaminant plume containment and remediation; mixed waste characterization, treatment, and disposal; high-level waste tank remediation; landfill stabilization; and decontamination and decommissioning.

23348 (DOE/EM–0253) **Decontamination and decommissioning focus area. Technology summary.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Jun 1995. 77p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016002. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents details of the facility deactivation, decommissioning, and material disposition research for development of new technologies sponsored by the Department of Energy. Topics discussed include; occupational safety, radiation protection, decontamination, remote operated equipment, mixed waste processing, recycling contaminated metals, and business opportunities.

23349 (DOE/EM–0255) **Radioactive Tank Waste Remediation Focus Area. Technology summary.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Jun 1995. 111p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016251. Source: OSTI; NTIS; INIS; GPO Dep.

In February 1991, DOE's Office of Technology Development created the Underground Storage Tank Integrated Demonstration (UST-ID), to develop technologies for tank remediation. Tank remediation across the DOE Complex has been driven by Federal Facility Compliance Agreements with individual sites. In 1994, the DOE Office of Environmental Management created the High Level Waste Tank Remediation Focus Area (TFA; of which UST-ID is now a part) to better integrate and coordinate tank waste remediation technology development efforts. The mission of both organizations is the same: to focus the development, testing, and evaluation of remediation technologies within a system architecture to characterize, retrieve, treat, concentrate, and dispose of radioactive waste stored in USTs at DOE facilities. The ultimate goal is to provide safe and cost-effective solutions that are acceptable to both the public and regulators. The TFA has focused on four DOE locations: the Hanford Site in Richland, Washington, the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho, the Oak Ridge Reservation in Oak Ridge, Tennessee, and the Savannah River Site (SRS) in Aiken, South Carolina.

23350 (DOE/EM–0257) **Environmental Restoration Strategic Plan. Remediating the nuclear weapons complex.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Aug 1995. 19p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016164. Source: OSTI; NTIS; INIS; GPO Dep.

With the end of the cold war, the US has a reduced need for nuclear weapons production. In response, the Department of Energy has redirected resources from weapons production to weapons dismantlement and environmental remediation. To this end, in November 1989, the US Department of Energy (DOE) established the Office of Environmental Restoration and Waste Management (renamed the Office of Environmental Management in 1994). It was created to bring under a central authority the management of radioactive and hazardous wastes at DOE sites and inactive or shut down facilities. The Environmental Restoration Program, a major component of DOE's Environmental Management Program, is responsible for the remediation and management of contaminated environmental media (e.g., soil, groundwater, sediments) and the decommissioning of facilities and structures at 130 sites in over 30 states and territories.

23351 (DOE/MC/29467–4080) **Decontamination systems information and research program. Quarterly report, January–March 1995.** National Research Center for Coal and Energy, Morgantown, WV (United States). Apr 1995. 360p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC29467. Order Number DE95009726. Source: OSTI; NTIS; GPO Dep.

The projects reported during this period are categorized into the following three areas: 1.0 Site Remediation Technologies, 2.0 Advanced Product Applications Testing, and 3.0 Information Systems, Public Policy, Community Outreach, and Economics. Summaries of the significant accomplishments for the projects reported during this period, are presented.

23352 (DOE/OR/21548–436-Rev.) **Weldon Spring Site Environmental Report for calendar year 1994.** MK-Ferguson Co., St. Charles, MO (United States); Jacobs Engineering Group, Inc., St. Charles, MO (United States). May 1995. 330p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21548. Order Number DE95015486. Source: OSTI; NTIS; INIS; GPO Dep.

This report for Calendar Year 1994 has been prepared to provide information about the public safety and environmental protection programs conducted by the Weldon Spring Site Remedial Action Project (WSSRAP). The Weldon Spring site is located in southern St. Charles County, Missouri, approximately 48 km (30 mi) west of St. Louis. The site consists of two main areas, the Weldon Spring Chemical Plant and raffinate pits and the Weldon Spring Quarry. The chemical plant, raffinate pits, and quarry are located on Missouri State Route 94, southwest of US Route 40/61. The objectives of the Site Environmental Report are to present a summary of data from the environmental monitoring program, to characterize trends and environmental conditions at the site, and to confirm compliance with environmental and health protection standards and requirements. The report also presents the status of remedial activities and the results of monitoring these activities to assess their

impacts on the public and environment. This report includes monitoring data from routine radiological and nonradiological sampling activities. These data include estimates of dose to the public from the Weldon Spring site, estimates of effluent releases, and trends in groundwater contaminant levels. Additionally, applicable compliance requirements, quality assurance programs, and special studies conducted in 1994 to support environmental protection programs are discussed. Dose estimates presented in this report are based on hypothetical exposure scenarios of public use of areas near the site. In addition, release estimates have been calculated on the basis of 1994 National Pollutant Discharge Elimination System (NPDES) and air monitoring data. Effluent discharges from the site under routine NPDES and National Emission Standards for Hazardous Air Pollutants (NESHAPS) monitoring were below permitted levels.

23353 (DOE/RL–94-61-Vol.1) **100 Area source operable unit focused feasibility study. Volume 1.** USDOE Richland Operations Office, WA (United States). Jun 1995. 896p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-93RL12367. Order Number DE95014150. Source: OSTI; NTIS; INIS; GPO Dep.

The 100 Area is one of four Hanford areas placed on the National Priority List of waste sites in 1989 under CERCLA authority. Purpose of this focused feasibility study (FFS) is to provide decision makers sufficient information to select interim remedial alternatives for IRM (interim remedial measures) candidate waste sites within the 100 Areas. Scope covers high-priority source waste sites (sites at which there was direct disposal of wastes or a direct release of hazardous substances). This FFS contains three major components; the first major component, Sections 1.0-7.0 and Appendices A, B, and C, is the Process Document, which describes the Remedial Alternatives developed for remediation of the 100 Area source waste sites, evaluates these alternatives against CERCLA and other environmental criteria, and compares the alternatives against each other. The Process Document addresses 10 logical groupings of individual waste sites. It evaluates remedial alternatives for each waste site group assuming their groundwater should be protected as a potential drinking water source and the remediated areas will be used for recreational or other occasional use. A second major component of this report, the Sensitivity Analysis (Appendix D), evaluates how the analysis might change for different exposure scenarios. The third major component comprises the operableunit specific FFSs prepared for the 100-HR-1, 100-BC-1, and 100-DR-1 Operable Units (Appendices E, F, and G).

23354 (DOE/RL–95-70) **Hanford Sampling Quality Management Plan (HSQMP).** Hyatt, J.E. Westinghouse Hanford Co., Richland, WA (United States). Jun 1995. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95016482. Source: OSTI; NTIS; INIS; GPO Dep.

HSQMP establishes quality requirements in response to DOE Order 5700. 6C and to 10 Code of Federal Regulations 830.120. HSQMP is designed to meet the needs of Richland Operations Office for controlling the quality of services provided by sampling operations. It is issued through the Analytical Services Program of the Waste Programs Division. This document describes the Environmental Sampling and Analysis Program activities considered to represent the best management activities necessary to achieve a sampling program with adequate control.

23355 (DOE/SR/18217–4) **Cancer and birth defects surveillance system for communities around the Savannah River Site. Phase 1, Technical progress report: Cancer.** Dunbar, J.B. Medical Univ. of South Carolina, Charleston, SC (United States). Dept. of Biometry and Epidemiology. May 1995. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-91SR18217. Order Number DE95012426. Source: OSTI; NTIS; INIS; GPO Dep.

Year 04 began the second three-year grant period, the overall goals of which were to consolidate and continue the aims of the first period, with the important exception that a great deal more effort would be expended on promoting community awareness and knowledge, as these characteristics relate to the residents' perceptions of major potential health effects. It was anticipated that more time would be available during the second period to accomplish this aim because the difficult early work of gaining hospital and community acceptance would have been done. Specifically, the goals were to: Maintain and refine the cancer registry; Inaugurate the birth defects registry if it were funded; and Enhance community involvement and education.

23356 (ES/ER/TM–106) **Preliminary remediation goals for use at the U.S. Department of Energy Oak Ridge Operations Office.** Oak Ridge National Lab., TN (United States). Jun 1995. 610p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013998. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents Preliminary Remediation Goals (PRGs) for use in human health risk assessment efforts under the United States Department of Energy, Oak Ridge Operations Office Environmental Restoration (ER) Division. Chemical-specific PRGs are concentration goals for individual chemicals for specific medium and land use combinations. The PRGs are referred to as risk-based because they have been calculated using risk assessment procedures. Risk-based calculations set concentration limits using both carcinogenic or noncarcinogenic toxicity values under specific exposure pathways. The PRG is a concentration that is derived from a specified excess cancer risk level or hazard quotient. This report provides the ER Division with standardized PRGs which are integral to the Remedial Investigation/Feasibility Study process. By managing the assumptions and systems used in PRG derivation, the Environmental Restoration Risk Assessment Program will be able to control the level of quality assurance associated with these risk-based guideline values.

23357 (ES/ER/TM–112/R2) **Environmental restoration risk-based prioritization work package planning and risk ranking methodology. Revision 2.** Dail, J.L.; Nanstad, L.D.; White, R.K. Lockheed Martin Energy Systems, Inc., Oak Ridge, TN (United States). Jun 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95015374. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Restoration Program.

This document presents the risk-based prioritization methodology developed to evaluate and rank Environmental Restoration (ER) work packages at the five US Department of Energy, Oak Ridge Field Office (DOE-ORO) sites [i.e., Oak Ridge K-25 Site (K-25), Portsmouth Gaseous Diffusion Plant (PORTS), Paducah Gaseous Diffusion Plant (PGDP), Oak Ridge National Laboratory (ORNL), and the Oak Ridge Y-12 Plant (Y-12)], the ER Off-site Program, and Central ER. This prioritization methodology was developed to support the increased rigor and formality of work planning in the overall conduct of operations within the DOE-ORO ER Program. Prioritization is conducted as an integral component of the fiscal ER funding cycle to establish program budget priorities. The purpose of the ER risk-based prioritization methodology is to provide ER management with the tools and processes needed to evaluate, compare, prioritize, and justify fiscal budget decisions for a diverse set of remedial action, decontamination and decommissioning, and waste management activities. The methodology provides the ER Program with a framework for (1) organizing information about identified DOE-ORO environmental problems, (2) generating qualitative assessments of the long- and short-term risks posed by DOE-ORO environmental problems, and (3) evaluating the benefits associated with candidate work packages designed to reduce those risks. Prioritization is conducted to rank ER work packages on the basis of the overall value (e.g., risk reduction, stakeholder confidence) each package provides to the ER Program. Application of the methodology yields individual work package "scores" and rankings that are used to develop fiscal budget requests. This document presents the technical basis for the decision support tools and process.

23358 (FEMP–2388) **Radium bearing waste disposal.** Tope, W.G. (Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States)); Nixon, D.A.; Smith, M.L.; Stone, T.J.; Vogel, R.A.; Schofield, W.D. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC24-92OR21972. (CONF-950401–11: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United

States), 30 Apr - 1 may 1995). Order Number DE95013793. Source: OSTI; NTIS; INIS; GPO Dep.

Fernald radium bearing ore residue waste, stored within Silos 1 and 2 (K-65) and Silo 3, will be vitrified for disposal at the Nevada Test Site (NTS). A comprehensive, parametric evaluation of waste form, packaging, and transportation alternatives was completed to identify the most cost-effective approach. The impacts of waste loading, waste form, regulatory requirements, NTS waste acceptance criteria, as-low-as-reasonably-achievable principles, and material handling costs were factored into the recommended approach.

23359 (LA-UR–95-1267) **Accident selection methodology for TA-55 FSAR.** Letellier, B.C. (and others); Pan, P.Y.; Sasser, M.K. Los Alamos National Lab., NM (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9506205–1: 5. annual safety analysis workshop of the Energy Facility Contractors Group (EFCOG), Augusta, GA (United States), 19-23 Jun 1995). Order Number DE95014017. Source: OSTI; NTIS; INIS; GPO Dep.

In the past, the selection of representative accidents for refined analysis from the numerous scenarios identified in hazards analyses (HAs) has involved significant judgment and has been difficult to defend. As part of upgrading the Final Safety Analysis Report (FSAR) for the TA-55 plutonium facility at the Los Alamos National Laboratory, an accident selection process was developed that is mostly mechanical and reproducible in nature and fulfills the requirements of the Department of Energy (DOE) Standard 3009 and DOE Order 5480.23. Among the objectives specified by this guidance are the requirements that accident screening (1) consider accidents during normal and abnormal operating conditions, (2) consider both design basis and beyond design basis accidents, (3) characterize accidents by category (operational, natural phenomena, etc.) and by type (spill, explosion, fire, etc.), and (4) identify accidents that bound all foreseeable accident types. The accident selection process described here in the context of the TA-55 FSAR is applicable to all types of DOE facilities.

23360 (LA-UR–95-1390) **Integrated chemical/biological treatment of paint stripper mixed waste: Metals toxicity and separation.** Vanderberg-Twary, L.; Grumbine, R.K.; Foreman, T.; Hanners, J.L.; Brainard, J.R.; Sauer, N.N.; Unkefer, P.J. Los Alamos National Lab., NM (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950877–13: 3. American Society for Mechanical Engineers biannual mixed waste symposium, Baltimore, MD (United States), 7-11 Aug 1995). Order Number DE95012055. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE complex has generated vast quantities of complex heterogeneous mixed wastes. Paint stripper waste (PSW) is a complex waste that arose from decontamination and decommissioning activities. It contains paint stripper, cheesecloth, cellulose-based paints with Pb and Cr, and suspect Pu. Los Alamos National Laboratory has 150–200 barrels of PSW and other national laboratories such as Rocky Flats Plant have many more barrels of heterogeneous waste. Few technologies exist that can treat this complex waste. Our approach to solving this problem is the integration of two established technologies: biodegradation and metals chelation.

23361 (MMSC-EM–95011) **Pinellas Plant Annual Site Environmental Report for calendar year 1994.** Lockheed Martin Specialty Components, Inc., Largo, FL (United States). Jun 1995. 146p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-92AL73000. Order Number DE95014021. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a comprehensive summary of the results of the Environmental Monitoring, Waste Management, and Environmental Restoration Programs at the Pinellas Plant, in Pinellas County, Florida for 1994. This report also includes the plant's performance in the areas of compliance with applicable regulatory requirements and standards and identifies major Environmental, Safety and Health Program initiatives and accomplishments for 1994. As a result of the end of Department of Energy Defense Programs mission production on September 30, 1994, considerable changes at the Pinellas Plant occurred. These changes, which included transitioning the plant toward alternate use in support of economic development and safe shutdown, both increased and heightened Environmental, Safety and Health responsibilities. In December 1994, the Department of Energy announced it had reached an agreement to sell the Pinellas Plant to the Pinellas County Industry Council in March 1995. The plant is being leased back by the Department of Energy through September 1997 to complete safe shutdown, reconfiguration, transfer of equipment to other Department of Energy production facilities, and transition to commercial ventures. Permit modifications and transfers will be completed during 1995 to reflect the new ownership by the Pinellas County Industry Council and to include new tenants as needed.

23362 (ORISE–93/J-42) **Data collection, validation, and description for the Oak Ridge nuclear facilities mortality study.** Watkins, J.P. (Oak Ridge Inst. for Science and Education, TN (United States). Center for Epidemiologic Research); Reagan, J.L.; Cragle, D.L.; West, C.M.; Tankersley, W.G.; Frome, E.L.; Crawford-Brown, D.J. Oak Ridge Inst. for Science and Education, TN (United States). [1995]. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE95013655. Source: OSTI; NTIS; INIS; GPO Dep.

To investigate the long-term health effects of protracted occupational exposure to low levels of ionizing radiation, a mortality study was initiated by pooling data for 118,588 workers hired between 1943 and 1982, at three Department of Energy (DOE) facilities in Oak Ridge, Tennessee, with follow-up through 1984. Topics for this discussion will include issues involving the collection and validation of data for individuals in the study cohort, and characteristics of their demographic and radiation exposure data. Since the data were compiled between the late 1960s and the present under the direction of several principal investigators, it was essential to verify data precision and to understand how exposure data were generated prior to beginning any analysis. A stratified random sample of workers in the cohort was chosen for verification of their computerized data as it appeared in the database. Original source documents were reviewed to verify demographic data, as well as internal and external radiation exposure data. Extensive effort was expended to document the personal radiation monitoring policies and types of dosimeters used at each facility over the 42 years included in the study. Characteristics of internal and external exposure data by facility and year were examined by graphical methods with the intent of combining these monitoring data over time and across facilities.

23363 (ORNL/RASA–94/3) **Results of the supplementary radiological survey at the former C. H. Schnoor and Company site, 644 Garfield Street, Springdale, Pennsylvania (CVP001).** Coleman, R.L.; Murray, M.E.; Brown, K.S. Oak Ridge National Lab., TN (United States). Apr 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012542. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the U.S. Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted radiological surveys at the former C. H. Schnoor and Company site, 644 Garfield Street, Springdale, Pennsylvania. The surveys were performed on October 11-13 and November 14-17, 1993, in order to provide a complete characterization prior to site remediation. The surveys included a gamma scan and a scan for surface contamination from alpha and beta-gamma emitters; measurement of direct and removable alpha and beta-gamma levels; systematic FIDLER measurements at the surface of the concrete; and the collection of samples from boreholes for radionuclide analysis. Results of the surveys revealed radionuclide concentrations and surface contamination levels in excess of applicable DOE guidelines for ^{238}U. Radionuclide distributions were higher than typical background levels for ^{238}U in the Springdale, Pennsylvania area.

23364 (ORNL/RASA–95/3) **Radiological verification survey results at 14 Peck Ave., Pequannock, New Jersey (PJ001V).** Rodriguez, R.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014467. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy (DOE) conducted remedial action during 1993 at the Pompton Plains Railroad Spur and eight vicinity properties in the Wayne and Pequannock Townships in

New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W. R. Grace facility. The property at 14 Peck Ave., Pequannock, New Jersey is one of these vicinity properties. At the request of DOE, a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at this property. The purpose of the survey, conducted between September and December 1993, was to confirm the success of the remedial actions performed to remove any radioactive materials in excess of the identified guidelines. The verification survey included surface gamma scans and gamma readings at 1 meter, beta-gamma scans, and the collection of soil and debris samples for radionuclide analysis. Results of the survey demonstrated that all radiological measurements on the property at 14 Peck Ave. were within applicable DOE guidelines. Based on the results of the remedial action data and confirmed by the verification survey data, the portions of the site that had been remediated during this action successfully meet the DOE remedial action objectives.

23365 (PNL–10637) **Identification of physical properties for the retrieval data quality objective process.** Gates, C.M.; Beckette, M.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015443. Source: OSTI; NTIS; INIS; GPO Dep.

This activity supports the retrieval data quality objective (DQO) process by identifying the material properties that are important to the design, development, and operation of retrieval equipment; the activity also provides justification for characterizing those properties. These properties, which control tank waste behavior during retrieval operations, are also critical to the development of valid physical simulants for designing retrieval equipment. The waste is to be retrieved in a series of four steps. First, a selected retrieval technology breaks up or dislodges the waste into subsequently smaller pieces. Then, the dislodged waste is conveyed out of the tank through the conveyance line. Next, the waste flows into a separator unit that separates the gaseous phase from the liquid and solid phases. Finally, a unit may be present to condition the slurried waste before transporting it to the treatment facility. This document describes the characterization needs for the proposed processes to accomplish waste retrieval. Baseline mobilization technologies include mixer pump technology, sluicing, and high-pressure water-jet cutting. Other processes that are discussed in this document include slurry formation, pneumatic conveyance, and slurry transport. Section 2.0 gives a background of the DQO process and the different retrieval technologies. Section 3.0 provides the mechanistic descriptions and material properties critical to the different technologies and processes. Supplemental information on specific technologies and processes is provided in the appendices. Appendix A contains a preliminary sluicing model, and Appendices B and C cover pneumatic transport and slurry transport, respectively, as prepared for this document. Appendix D contains sample calculations for various equations.

23366 (PNL-SA–24280) **Deploying in situ bioremediation at the Hanford Site.** Truex, M.J.; Johnson, C.D.; Newcomer, D.R.; Doremus, L.A.; Hooker, B.S.; Peyton, B.M.; Skeen, R.S.; Chilakapati, A. Pacific Northwest Lab., Richland, WA (United States). Nov 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-941124–23: 33. Hanford symposium on health and the environment: symposium on in-situ remediation–scientific basis for current and future technologies, Richland, WA (United States), 7-11 Nov 1994). Order Number DE95014625. Source: OSTI; NTIS; INIS; GPO Dep.

An innovative in-situ bioremediation technology was developed by Pacific Northwest Laboratory (PNL) to destroy nitrate and carbon tetrachloride ($CC1_4$) in the Hanford ground water. The goal of this in-situ treatment process is to stimulate native microorganisms to degrade nitrate and CCl_4. Nutrient solutions are distributed in the contaminated aquifer to create a biological treatment zone. This technology is being demonstrated at the US Department of Energy's Hanford Site to provide the design, operating, and cost information needed to assess its effectiveness in contaminated ground water. The process design and field operations for demonstration of this technology are influenced by the physical, chemical, and microbiological properties observed at the site. A description of the technology is presented including the well network design, nutrient injection equipment, and means for controlling the hydraulics and microbial reactions of the treatment process.

23367 (RFP–4969) **Summary report of incineration plenum fire: Building 771, July 2, 1980.** Fretthold, J.K. (ed.). Rocky Flats Environmental Technology Site, Golden, CO (United States). 31 May 1995. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. Order Number DE95014665. Source: OSTI; NTIS; INIS; GPO Dep.

At about 1100 on July 2, 1980, a temperature rise above normal was recorded on charts monitoring operation of the incinerator in Room 149, Building 771. The plenum overheat alarm sounded at 1215, emergency actions initiated, and the fire was extinguished and mop-up began at about 1300. Investigation determined that the fire in the plenum was caused by a heat rise in the system, a deteriorated bypass valve on the No. 3 heat exchanger (KOH scrubber), nitration of the urethane seal on the HEPA filter media to the filter frame, and accumulation of metallic fines on the filter media. It was concluded that the management system responded properly, except for the ring- down system to activate the Emergency Operations Center.

23368 (RFP–4971) **Integrated chemical management system: A tool for managing chemical information at the Rocky Flats Environmental Technology Site.** Costain, D. (Kaiser-Hill Co., Golden, CO (United States)). EG and G Rocky Flats, Inc., Golden, CO (United States). [1995]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. (CONF-9506210–2: 10. annual Federal facilities conference, Denver, CO (United States), 29 Jun 1995). Order Number DE95014671. Source: OSTI; NTIS; GPO Dep.

The Integrated Chemical Management System is a computer-based chemical information at the Rocky Flats Environmental Technology Site. Chemical containers are identified by bar code labels and information on the type, quantity and location of chemicals are tracked on individual data bases in separate buildings. Chemical inventories from multiple buildings are uploaded to a central sitewide chemical data base where reports are available from Product, Waste, and Chemical Use modules. Hazardous chemical information is provided by a separate Material Safety Data Sheet module and excess chemicals are traded between chemical owners and users with the aid of the Chemical Exchange Module.

23369 (SAND–94-2611) **Identification of remediation needs and technology development focus areas for the Environmental Restoration (ER) Project at Sandia National Laboratories/New Mexico (SNL/NM).** Tucker, M.D. (Sandia National Labs., Albuquerque, NM (United States). Site Restoration Technology Program Office); Valdez, J.M.; Khan, M.A. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015010. Source: OSTI; NTIS; INIS; GPO Dep.

The Environmental Restoration (ER) Project has been tasked with the characterization, assessment, remediation and long-term monitoring of contaminated waste sites at Sandia National Laboratories/New Mexico (SNL/NM). Many of these sites will require remediation which will involve the use of baseline technologies, innovative technologies that are currently under development, and new methods which will be developed in the near future. The Technology Applications Program (TAP) supports the ER Project and is responsible for development of new technologies for use at the contaminated waste sites, including technologies that will be used for remediation and restoration of these sites. The purpose of this report is to define the remediation needs of the ER Project and to identify those remediation needs for which the baseline technologies and the current development efforts are inadequate. The area between the remediation needs and the existing baseline/innovative technology base represents a technology gap which must be filled in order to remediate contaminated waste sites at SNL/NM economically and efficiently. In the first part of this report, the remediation needs of the ER Project are defined by both the

ER Project task leaders and by TAP personnel. The next section outlines the baseline technologies, including EPA defined Best Demonstrated Available Technologies (BDATs), that are applicable at SNL/NM ER sites. This is followed by recommendations of innovative technologies that are currently being developed that may also be applicable at SNL/NM ER sites. Finally, the gap between the existing baseline/innovative technology base and the remediation needs is identified. This technology gap will help define the future direction of technology development for the ER Project.

23370 (SAND–95-1304) **Building 891 hazards assessment document.** Banda, Z.; Barnett, B. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 280p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015407. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy Order 5500.3A requires facility-specific hazards assessments be prepared, maintained, and used for emergency planning purposes. This hazards assessment document describes the chemical and radiological hazards associated with Building 891. The entire inventory was screened according to the potential airborne impact to onsite and offsite individuals. The air dispersion model, ALOHA, estimated pollutant concentrations downwind from the source of a release, taking into consideration the toxicological and physical characteristics of the release site, the atmospheric conditions, and the circumstances of the release. The greatest distance at which a postulated facility event will produce consequences exceeding the Early Severe Health Effects threshold is 33 meters. The highest emergency classification is a Site Area Emergency. The Emergency Planning Zone is a nominal 50 meter area that conforms to DOE boundaries and physical/jurisdictional boundaries such as fence lines and streets.

23371 (UCRL-JC–119038) **DOE natural phenomenal hazards design and evaluation criteria.** Murray, R.C. (Lawrence Livermore National Lab., CA (United States)); Nelson, T.A.; Short, S.A.; Kennedy, R.P.; Chander, H.; Hill, J.R.; Kimball, J.K. Lawrence Livermore National Lab., CA (United States). Oct 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941227–6: 5. symposium on current issues related to nuclear power plant structure, equipment and piping, Orlando, FL (United States), 14-16 Dec 1994). Order Number DE95011762. Source: OSTI; NTIS; INIS; GPO Dep.

It is the policy of the Department of Energy (DOE) to design, construct, and operate DOE facilities so that workers, the general public, and the environment are protected from the impacts of natural phenomena hazards (NPH). Furthermore, DOE has established explicit goals of acceptable risk for NPH performance. As a result, natural phenomena hazard (earthquake, extreme wind, and flood) design and evaluation criteria for DOE facilities have been developed based on target probabilistic performance goals. These criteria include selection of design/evaluation NPH input from probabilistic hazard curves combined with commonly practiced deterministic response evaluation methods and acceptance criteria with controlled levels of conservatism. For earthquake considerations, conservatism is intentionally introduced in specification of material strengths and capacities, in the allowance of limited inelastic behavior, and by a seismic scale factor. Criteria have been developed following a graded approach for several performance goals ranging from that appropriate for normal-use facilities to that appropriate for facilities involving hazardous or critical operations. Performance goals are comprised of qualitative expressions of acceptable behavior and of target quantitative probabilities that acceptable limits of behavior are maintained. The criteria are simple procedures but have a rigorous basis. This paper addresses DOE seismic design and evaluation criteria.

23372 (WHC-SA–2623) **Tank waste remediation system: An update.** Alumkal, W.T.; Babad, H.; Dunford, G.L.; Honeyman, J.O.; Wodrich, D.D. Westinghouse Hanford Co., Richland, WA (United States). Feb 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-950216–151: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95013487. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's Hanford Site, located in southeastern Washington State, contains the largest amount and the most diverse collection of highly radioactive waste in the US. High-level radioactive waste has been stored at the Hanford Site in large, underground tanks since 1944. Approximately 217,000 M^3 (57 Mgal) of caustic liquids, slurries, saltcakes, and sludges have accumulated in 177 tanks. In addition, significant amounts of ^{90}Sr and ^{137}Cs were removed from the tank waste, converted to salts, doubly encapsulated in metal containers, and stored in water basins. The Tank Waste Remediation System Program was established by the US Department of Energy in 1991 to safely manage and immobilize these wastes in anticipation of permanent disposal of the high-level waste fraction in a geologic repository. Since 1991, significant progress has been made in resolving waste tank safety issues, upgrading Tank Farm facilities and operations, and developing a new strategy for retrieving, treating, and immobilizing the waste for disposal.

23373 (WHC-SD-CP-CR–036) **PFP supply fan motor starters.** Keck, R.D. Westinghouse Hanford Co., Richland, WA (United States). 31 May 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014309. Source: OSTI; NTIS; INIS; GPO Dep.

The Plutonium Finishing Plant (PFP) is currently stabilizing about 25 kg of Pu sludge; upon completion of this task, PFP will be maintained in a safe standby condition to await decision from the PFP NEPA review. It can take about 10 years to initiate and complete terminal cleanout after this; the facility will then be decommissioned and decontaminated. The 234-5Z ventilation system must continue to operate until terminal cleanout. Part of the ventilation system is the seismic fan shutdown system which shuts down the ventilation supply fans in case of strong earthquake. This document presents criteria for installing solid state, reduced voltage motor starters and isolation contactors for the 8 main ventilation supply fans. The isolation contactors will shutdown the supply fans in event of earthquake.

23374 (WHC-SD-CP-MAR–002) **PUREX Plant deactivation mission analysis report.** Lund, D.P. Westinghouse Hanford Co., Richland, WA (United States). 24 May 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013878. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the PUREX Deactivation Project mission analysis is to define the problem to be addressed by the PUREX mission, and to lay the ground work for further system definition. The mission analysis is an important first step in the System Engineering (SE) process. This report presents the results of the PUREX Deactivation Project mission analysis. The purpose of the PUREX Deactivation Project is to prepare PUREX for Decontamination and Decommissioning within a five year time frame. This will be accomplished by establishing a passively safe and environmentally secure configuration of the PUREX Plant, that can be preserved for a 10-year horizon. During deactivation, appropriate portions of the safety envelop will be maintained to ensure deactivation takes place in a safe and regulatory compliant manner.

23375 (WHC-SD-CP-SDD–004-Rev.2) **Definition and means of maintaining the supply ventilation system seismic shutdown portion of the PFP safety envelope. Revision 2.** Keck, R.D. Westinghouse Hanford Co., Richland, WA (United States). 27 Jun 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015547. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the modifications to the ventilation system for the Plutonium Finishing Plant. Topics discussed in this report include; system functional requirements, evaluations of equipment, a list of drawings showing the safety envelope boundaries; list of safety envelope equipment, functional requirements for individual safety envelope equipment, and a list of the operational, maintenance and surveillance procedures necessary to operate and maintain the system equipment.

23376 (WHC-SD-TP-SEP–034) **Safety evaluation for packaging CPC metal boxes.** Romano, T. Westinghouse Hanford Co., Richland, WA (United States). 15 May 1995. 2p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012577. Source: OSTI; NTIS; INIS; GPO Dep.

This Safety Evaluation for Packaging (SEP) provides authorization for the use of Container Products Corporation (CPC) metal boxes, as described in this document, for the interarea shipment of radioactive contaminated equipment and debris for storage in the Central Waste Complex (CWC) or T Plant located in the 200 West Area. Authorization is granted until November 30, 1995. The CPC boxes included in this SEP were originally procured as US Department of Transportation (DOT) Specification 7A Type A boxes. A review of the documentation provided by the manufacturer revealed the documentation did not adequately demonstrate compliance to the 4 ft drop test requirement of 49 CFR 173.465(c). Preparation of a SEP is necessary to document the equivalent safety of the onsite shipment in lieu of meeting DOT packaging requirements until adequate documentation is received. The equivalent safety of the shipment is based on the fact that the radioactive contents consist of contaminated equipment and debris which are not dispersible. Each piece is wrapped in two layers of no less than 4 mil plastic prior to being placed in the box which has an additional 10 mil liner. Pointed objects and sharp edges are padded to prevent puncture of the plastic liner and wrapping.

23377 (WHC-SD-WM-ES–337) **Cost benefit and risk assessment for selected tank waste process testing alternatives.** Gasper, K.A. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Foster-Wheeler Environmental Corp., Richland, WA (United States). 22 May 1995. 644p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013837. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy has established the Tank Waste Remediation System (TWRS) program to safely manage wastes currently stored in underground tank at the Hanford Site. A TWRS testing and development strategy was recently developed to define long-range TWRS testing plans. The testing and development strategy considered four alternatives. The primary variable in the alternatives is the level of pilot-scale testing involving actual waste. This study evaluates the cost benefit and risks associated with the four alternatives. Four types of risk were evaluated: programmatic schedule risk, process mishap risk, worker risk, and public health risk. The structure of this report is as follows: Section 1 introduces the report subject; Section 2 describes the test strategy alternative evaluation; Section 3 describes the approach used in this study to assess risk and cost benefit; Section 4 describes the assessment methodologies for costs and risks; Section 5 describes the bases and assumptions used to estimate the costs and risks; Section 6 presents the detailed costs and risks; and Section 7 describes the results of the cost benefit analysis and presents conclusions.

23378 (WHC-SP–0564-37) **Westinghouse Hanford Company Health and Safety Performance Report. First quarter calendar year 1995.** Lansing, K.A. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013514. Source: OSTI; NTIS; GPO Dep.

During the first quarter of CY 1995, four of the WHC sitewide ALARA performance goals were completed on or ahead of schedule. One of the completed goals related to reduction of radiological areas at WHC-managed facilities. Due to anticipated resource reductions and increased scope of work, several facilities escalated their reduction schedule. This allowed the ALARA goal to be completed and exceeded ahead of schedule. Industrial Safety and Health initiatives are being pursued in areas such as workplace ergonomics, safety training, and standards development. Positive efforts are ongoing in the areas of management commitment and employee involvement through the WHC Voluntary Protection Program. Successful implementation continues through the President's Accident Prevention Council (PAPC) and division employee Accident Prevention Councils. The Company now has established CY 1995 PAPC goals. Major programmatic accomplishments completed during this reporting period include the Department of Energy-Headquarters (DOE-HQ) formally endorsing the Radiological Control organization's approach toward development of the Radiation Protection Program (RPP) document. The DOE-HQ has recognized the significant contributions and leadership that Radiological Control has provided in planning and implementation of this "model example of an RPP" across the DOE complex and is encouraging other sites to contact WHC for assistance in developing their RPPs.

23379 (WSRC-TR–93-301-Rev.4) **Human Reliability Analysis for In-Tank Precipitation Alignment and Startup of Emergency Purge Ventilation Equipment. Revision 4.** Shapiro, B.J.; Britt, T.E. Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1995. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060156. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the methodology used for calculating the human error probability for establishing air based ventilation using emergency purge ventilation equipment on In-Tank Precipitation (ITP) processing tanks 48 and 49 after a failure of the nitrogen purge system following a seismic event. The analyses were performed according to THERP (Technique for Human Error Rate Prediction) as describes in NUREG/CR-1278-F.

23380 (WSRC-TR–94-0540) **Isothermal heat measurements of TBP-nitric acid solutions.** Smith, J.R.; Cavin, W.S. Westinghouse Savannah River Co., Aiken, SC (United States). 16 Dec 1994. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95014731. Source: OSTI; NTIS; INIS; GPO Dep.

Net heats of reaction were measured in an isothermal calorimeter for both single phase (organic) and two phase (organic and aqueous) TBP/HNO_3 reacting solutions at temperatures above 100 C. The oxidation rate constant was determined to be 5.4E-4 min^{-1} at 110 C for an open "vented" system as compared to 1.33 E-3 min^{-1} in the closed system. The heat released per unit material oxidized was also reduced. The oxidation in both phases was found to be first order in nitric acid and pseudo-zero order in butylnitrate and water. The hydrolysis (esterification) rate constant determined by Nichols' (1.33E-3 min^{-1}) fit the experimental data from this work well. Forced evaporation of the volatile components by the product gases from oxidation resulted in a cooling mechanism which more than balanced the heat from the oxidation reaction in the two-phased systems. Rate expressions were derived and rate constants determined for both the single and two phase systems. An approximating mathematical model was developed to fit the experimental data and to extrapolate beyond the experimental conditions. This model shows that one foot of "reacting" 14.3M HNO_3 aqueous phase solution at 121 C will transport sufficient water to the organic phase to replace evaporative losses, maintaining endothermicity, for organic layers up to 12.2 ÷ 6.0 feet deep. If the pressure in a reacting system is allowed to increase due to insufficient venting the temperature of the organic phase would increase in temperature to reach a new equilibrium. The rate of oxidation would increase not only due to the increase in temperature but also from the increased concentration of dissolved HNO_3 reduction products. Another important factor is that the cooling system described in this work becomes less effective as the total pressure increases. These factors probably contributed to the explosion at Tomsk.

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Refer also to citation(s) 23305, 23543, 23786, 23829, 24410, 24590

23381 (BNL–60690) **HEU age determination.** Moorthy, A.R.; Kato, W.Y. Brookhaven National Lab., Upton, NY (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-940748–100: 35. annual meeting of the Institute of Nuclear Materials Management (INMM), Naples, FL (United States), 17-20 Jul 1994). Order Number DE95014520. Source: OSTI; NTIS; INIS; GPO Dep.

A criteria that a sample of highly enriched uranium (HEU) had come from a weapons stockpile and not newly produced in an enrichment plant is to show that the HEU had been produced a significant time in the past. The time since the HEU has produced in an enrichment plant is defined as the age of the HEU in this paper. The HEU age is determined by measuring quantitatively the

daughter products ^{230}Th and ^{231}Pa of ^{234}U and ^{235}U, respectively, by first chemical separation of the thorium and protactinium and then conducting alpha spectrometry of the daughter products.

23382 (DOE/AL/85832–T3) **Continuation application for the Amarillo National Resource Center for Plutonium, a higher education consortium consisting of Texas A and M University, Texas Tech University, and the University of Texas at Austin.** Amarillo National Resource Center for Plutonium, TX (United States). 29 Jun 1995. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-95AL85832. Order Number DE95015501. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the 5 tasks to be covered under this project and compiles budget information. Task 1 is to establish a Plutonium Information Resource, which has been established in Amarillo, Texas. Task 2, Advisory Functions, coordinates studies and activities relating to the disposition of excess weapons-grade plutonium. Task 3, Environmental, Public Health, and Safety, supports soil remediation activities. Task 4, Education and Outreach, is supporting four programs: K–12 education improvement in science and math courses; Academic intervention to identify and encourage high ability high school and middle school students with potential to become scientists and engineers; Graduate education evaluation; and Public outreach programs. Task 5, Plutonium and other Materials Studies, is currently funding two projects for the disposition of high explosives: a feasibility study of burning a mixture of high explosives and other materials in a commercial coal-fired power plant and synthesis of diamond by shock compression of bucky ball with explosives.

23383 (DOE/AL/85832–T6) **[Establish and manage a National Resource Center for plutonium, Quarterly report, April 1, 1995–June 30, 1995].** Mulder, R. Amarillo National Resource Center for Plutonium, TX (United States). 27 Jun 1995. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-95AL85832. Order Number DE95015526. Source: OSTI; NTIS; INIS; GPO Dep.

The initial phase of the Plutonium Information Resource is well under way. Board members developed linkages with Russian scientists and engineers and obtained names of technical team members. Nuclear proposals were reviewed by the Nuclear Review Group, and the proposals were modified to incorporate the review group's comments. Portions of the proposals were approved by the Governing Board. Proposals for education and outreach were reviewed by the Education Proposal Review Group, considered by the Governing Board and approved. The Senior Technical Review Group met to consider the R&D programs associated with fissile materials disposal. A newsletter was published. Progress continued on the high explosives demonstration project, on site-specific environmental work, and the multiattribute utility analysis. Center offices in Amarillo were furnished, equipment was purchased, and the lease was modified.

23384 (DOE/AL/85832–T7) **A methodology for the analysis and selection of alternatives for the disposition of surplus plutonium. Quarterly technical progress report, April 1, 1995–June 30, 1995.** Mulder, R. Amarillo National Resource Center for Plutonium, TX (United States). 5 Jul 1995. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-95AL85832. Order Number DE95015527. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Fissile Materials Disposition is currently involved in the development of a comprehensive approach to the long-term storage and disposition of fissile materials. A major objective of this effort is to provide a framework for US efforts to prevent the proliferation of nuclear weapons. This will entail both the elimination of excess highly enriched uranium and plutonium, and the insurance of the highest standards of safety, security, and international accountability. The Office of Fissile Materials Disposition is supporting an Interagency Working Group that has initiated a comprehensive review of alternatives for plutonium disposition which takes into account non-proliferation, economic, technical, institutional, schedule, environmental, and health and safety issues. These alternatives were identified by the development of screening criteria as a guide to the selection of alternatives that best achieve the fissile nuclear material long-term storage and disposition goals of the US Government.

23385 (HW–41274) **Americium-curium correction.** Reas, W.H. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 2 Feb 1956. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014055. Source: OSTI; NTIS; GPO Dep.

Short communication. CURIUM/alpha decay; PLUTONIUM/alpha decay; PLUTONIUM/accounting; COUNTING TECHNIQUES/alpha decay; CURIUM; PLUTONIUM; ACCOUNTING; HANFORD PRODUCTION REACTORS; IRRADIATION; ACCURACY

23386 (ORNL/MD/LTR–13) **New glass material oxidation and dissolution system facility: Direct conversion of surplus fissile materials, spent nuclear fuel, and other material to high-level-waste glass. Storage and disposition of weapons-usable fissile materials programmatic environmental impact statement data report: Predecisional draft.** Forsberg, C.W. (Oak Ridge National Lab., TN (United States). Chemical Technology Div.); Elam, K.R.; Reich, W.J. Oak Ridge National Lab., TN (United States). 28 Mar 1995. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011767. Source: OSTI; NTIS; INIS; GPO Dep.

With the end of the Cold War, countries have excess plutonium and other materials from the reductions in inventories of nuclear weapons. It has been recommended that these surplus fissile materials (SFMs) be processed so that they are no more accessible than plutonium in spent nuclear fuel (SNF). This SNF standard, if adopted worldwide, would prevent rapid recovery of SFMs for the manufacture of nuclear weapons. This report provides for the PEIS the necessary input data on a new method for the disposition of SFMs: the simultaneous conversion of SFMs, SNF, and other highly radioactive materials into high-level-waste (HLW) glass. The SFMs include plutonium, neptunium, americium, and ^{233}U. The primary SFM is plutonium. The preferred SNF is degraded SNF, which may require processing before it can be accepted by a geological repository for disposal. The primary form of this SNF is Hanford-N SNF with preirradiation uranium enrichments between 0.95 and 1.08%. The final product is a plutonium, low-enriched-uranium, HLW, borosilicate glass for disposition in a geological repository. The proposed conversion process is the Glass Material Oxidation and Dissolution System (GMODS), which is a new process. The initial analysis of the GMODS process indicates that a MODS facility for this application would be similar in size and environmental impact to the Defense Waste Processing Facility (DWPF) at the Savannah River Site. Because of this, the detailed information available on DWPF was used as the basis for much of the GMODS input into the SFMs PEIS.

23387 (ORNL/TM–12979) **Independent verification of reprocessing input and process volumes. Progress report.** Smith, D.H.; Turner, M.L.; McBay, E.H.; Lewis, B.E.; Hobson, D.E.; Ehinger, M.H. Oak Ridge National Lab., TN (United States). Apr 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014465. Source: OSTI; NTIS; INIS; GPO Dep.

One of the most difficult challenges in the nuclear fuel cycle is to establish a material balance for tanks containing spent fuel solutions. These tanks present an extremely hostile environment to the analyst, making determination of the amount of fissile material in them difficult. Historic methods used to determine the volumes of solutions in these tanks are usually based on use of tank geometry in conjunction with depth and density measurements, both of which vary with temperature and are normally controlled by the operator of the facility. Changes in the interior geometry of tanks due to addition of various types of equipment, minor structural modifications, and accumulation of insoluble materials at the bottom and on the interior surfaces of the tanks affect the available volume and make difficult its accurate measurement. For safeguards purposes, it is thus desirable to have a repeatable method of volume determination independent of the operator and other factors. To determine the quantity of uranium and plutonium in a given tank, aliquots are withdrawn and subjected to analysis; both isotopic abundances and the amount of each element present are determined. Isotope dilution mass spectrometry is the method of choice for quantitative measurements in this application and yields values more precise and accurate than other methods. In the research that is the focus

of this project, the application of isotope dilution mass spectrometry has been extended, through use of a double lutetium spike, to the determination of the volume (or weight) of the solution in tanks of any size and shape, regardless of the nature of the solutions within them. The goal of the work described in this report was to develop hot-cell compatible chemical separation procedures for lutetium and to try to devise a better method for quantitatively introducing natural lutetium to the tank.

23388 (PNL-D–376) **Impact assessment of additional safeguards and security controls on selected nuclides.** Simpson, C.L. Pacific Northwest Lab., Richland, WA (United States). 11 Oct 1984. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012666. Source: OSTI; NTIS; GPO Dep.

Battelle, Pacific Northwest Laboratory (PNL) has reviewed the current and projected inventory quantities of the selected nuclides in the reference letter and completed a quick assessment of the impacts of the additional safeguards and security controls. The areas that will be impacted are; physical protection, measurement systems, manual revisions, computer systems, and training.

23389 (PNL-D–405) **Assessment of Critical Mass Laboratory safeguards and security upgrades.** Merrill, B.J.; DeMyer, J.J. Pacific Northwest Lab., Richland, WA (United States). 31 May 1985. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012668. Source: OSTI; NTIS; GPO Dep.

Pacific Northwest Laboratory (PNL) conducted an evaluation of the safeguards and security systems at the Critical Mass Laboratory (CML) in February 1985, to identify appropriate upgrading actions necessary to ensure that effective and efficient systems consistent with DOE-RL policies, procedures, and site priorities are in place. Since that evaluation, there have been changes in Patrol contingency philosophy, response tactics, and distribution of manpower. Because of these changes, and at the request of DOE-RL, PNL has re-evaluated the safeguards and security systems in place at CML.

23390 (PNL-SA–23817) **Tamper tape seals.** Wright, B.W.; Undem, H.A. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940748–101: 35. annual meeting of the Institute of Nuclear Materials Management (INMM), Naples, FL (United States), 17-20 Jul 1994). Order Number DE95014626. Source: OSTI; NTIS; INIS; GPO Dep.

Tamper tapes are appealing for many applications due to their ease of use and relative robustness. Applications include seals for temporary area denial, protection of sensitive equipment, chain-of-custody audit trails, and inventory control practices. A next generation of adhesive tamper tapes is being developed that combines the best features of commercially available devices with additional state-of-the-art features in tamper indication, tamper-resistance, and counterfeit-resistance. The additional features are based on U.S. Department of Energy (DOE) research and development (R&D) activities that were originally associated with preparations for the Strategic Arms Reduction Treaty (START). New features include rapid-set, chemical-cure adhesive systems that allow user-friendly application and layered levels of counterfeit-resistance based on unique "fingerprint" characteristics that can be accessed as desired.

23391 (PNL-SA–26411) **Basic visual observation skills training course. Final report.** Toquam, J.L.; Morris. F.A.; Griggs, J.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (ISPO–378). Order Number DE95015179. Source: OSTI; NTIS; INIS; GPO Dep.

This is the third report in a series prepared to assist the International Atomic Energy Agency (IAEA or Agency) in enhancing the effectiveness of its international safeguards inspections through inspector training in Observation Skills. The first report (Phase 1) was essentially exploratory. It defined Observation Skills' broadly to include all appropriate cognitive, communications, and interpersonal techniques that have the potential to help IAEA safeguards inspectors function more effectively. The second report (Phase 2) provided a more specific basis for the actual design and delivery of Observation Skills training to IAEA inspectors. The present report (Phase 3) documents the design of a Basic Visual Observation Skills course and delivery of the course to safeguards inspectors at IAEA Headquarters Vienna in February and May of 1995. The purpose of the course is to help safeguards inspectors evaluate and improve their skills in making observations during inspections and in evaluating and interpreting this information. The course is basic in the sense that it provides training in skills which are generally applicable to inspections of all types of facilities and activities subject to safeguards. The course is designed for 16 hours of classroom delivery, ideally in four 4-hour sessions over a period of four days. The first 12 hours provide training in five skill areas: perception and recognition; attention and attention to detail; memory; mental imaging, mapping, and modeling skills; and judgment and decision making. Following the training in each of the five skill areas is an Integrating Exercise involving a simulated safeguards inspection.

23392 (PNL-SA–26411-App.A) **Basic visual observation skills training course: Appendix A. Final report.** Toquam, J.L.; Morris, F.A.; Griggs, J.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 187p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (ISPO–378-App.A). Order Number DE95015180. Source: OSTI; NTIS; INIS; GPO Dep.

Includes vugraphs.

The purpose of the basic visual observation skills course is to help safeguards inspectors evaluate and improve their skills in making observations during inspections and in evaluating and interpreting this information. The first 12 hours of the course provide training in five skill areas: perception and recognition; attention to detail; memory; mental imaging, mapping, and modeling skills; and judgment and decision making. Following this training is an integrating exercise involving a simulated safeguards inspection. This report contains the course manual and materials.

23393 (PNL-SA–26411-App.B) **Basic visual observation skills training course: Appendix B. Final report.** Toquam, J.L.; Morris, F.A.; Griggs, J.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (ISPO–378-App.B). Order Number DE95015181. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the basic visual observation skills course is to help safeguards inspectors evaluate and improve their skills in making observations during inspections and in evaluating and interpreting this information. The first 12 hours of the course provide training in five skill areas: perception and recognition; attention to detail; memory; mental imaging, mapping, and modeling skills; and judgment and decision making. Following this training is an integrating exercise involving a simulated safeguards inspection. This report contains the in-class exercises in the five skill areas; pre- and post-course exercises in closure, hidden figures, map memory, and mental rotations; the final examination; a training evaluation form; and the integrating exercise.

23394 (RFP–4973) **Nondestructive assay (NDA) of fissile material solutions in tanks at Rocky Flats Environmental Technology Site.** Fleissner, J.G.; Lamb, F.W.; Maul, M.R. Safe Sites of Colorado, Golden, CO (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. (CONF-950787–6: 36. annual meeting of the Institute for Nuclear Materials Management, Palm Desert, CA (United States), 9-12 Jul 1995). Order Number DE95015352. Source: OSTI; NTiS; INIS; GPO Dep.

Nondestructive assay of holdup in solution tanks at Rocky Flats has been performed to address criticality safety concerns since 1974. Destructive analysis techniques were used for quantification of the fissile material content of the tanks. With termination of operations in 1989, including sparging and sampling of tanks, a need arose for nondestructive assay of solutions in tanks to confirm previous inventory values. Gamma ray measurement methodologies were investigated and several techniques, including Poor Man's Densitometry were implemented. These techniques have been applied to several different types of tanks including: annular, raschig ring filled, and pencil tanks. For the annular tanks "Poor Man's

Densitometry" is used, with the densities of the measured solutions normalized to the value of one "accepted" concentration tank. Measurement uncertainties for this technique has been better than was anticipated. Measurements are also performed at several levels to attempt to detect variations in density. For the current tank draining program, solution in tanks is assayed by the NDA gamma-ray technique before draining. Measurement results were obtained for plutonium, uranium, and mixtures of U/Pu solutions for concentrations ranging from less than 0.5 g/l to 150 g/l. Tanks with expected concentrations were used to establish a relationship between concentration and count rate. "Bootstrapping" calibration techniques were used in some cases to obtain quantitative results.

23395 (SAND–94-3151C) **Reliable motion detection of small targets in video with low signal-to-clutter ratios.** Nichols, S.A.; Naylor, R.B. Sandia National Labs., Albuquerque, NM (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950793–2: 40. annual meeting of the Society of Photo-Optical Instrumentation Engineers: international symposium on optical science, engineering and instrumentation, San Diego, CA (United States), 9-14 Jul 1995). Order Number DE95013859. Source: OSTI; NTIS; GPO Dep.

Studies show that vigilance decreases rapidly after several minutes when human operators are required to search live video for infrequent intrusion detections. Therefore, there is a need for systems which can automatically detect targets in live video and reserve the operator's attention for assessment only. Thus far, automated systems have not simultaneously provided adequate detection sensitivity, false alarm suppression, and ease of setup when used in external, unconstrained environments. This unsatisfactory performance can be exacerbated by poor video imagery with low contrast, high noise, dynamic clutter, image misregistration, and/or the presence of small, slow, or erratically moving targets. This paper describes a highly adaptive video motion detection and tracking algorithm which has been developed as part of Sandia's Advanced Exterior Sensor (AES) program. The AES is a wide-area detection and assessment system for use in unconstrained exterior security applications. The AES detection and tracking algorithm provides good performance under stressing data and environmental conditions. Features of the algorithm include: reliable detection with negligible false alarm rate of variable velocity targets having low signal-to-clutter ratios; reliable tracking of targets that exhibit motion that is non-inertial, i.e., varies in direction and velocity; automatic adaptation to both infrared and visible imagery with variable quality; and suppression of false alarms caused by sensor flaws and/or cutouts.

23396 (SAND–95-1245C) **A Long-Range Video Observation Post.** Arlowe, D. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506201–1: 11. security technology symposium and exhibitioon, Virginia Beach, VA (United States), 19-22 Jun 1995). Order Number DE95014214. Source: OSTI; NTIS; GPO Dep.

The Long Range Video Observation Post (LRVOP) Project is a cooperative effort between the US and a Middle Eastern country to develop an improved version of their current video observation post. This project is part of a larger effort to cooperatively develop anti-terrorist technology. This particular equipment is required to facilitate the recording and identification of humans at a range of 1000 meters in day-light and 500 meters at night. The project objective was to take advantage of recent advances in camera technology, recorders, and image processing to provide an significant increase in performance with only a minimum increase in size, weight, and cost. The goal of the project was to convert the users general needs and desires into specific requirements that could be bid on by several companies. This paper covers the specific performance requirements, generally describe the components that might be used, and concentrate on describing the more difficult issues and technical challenges.

23397 (SAND–95-1253C) **Intra-site Secure Transport Vehicle test and evaluation.** Scott, S. Sandia National Labs., Albuquerque, NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506201–3: 11. security technology symposium and exhibitioon, Virginia Beach, VA (United States), 19-22 Jun 1995). Order Number DE95014215. Source: OSTI; NTIS; INIS; GPO Dep.

In the past many DOE and DoD facilities involved in handling nuclear material realized a need to enhance the safety and security for movement of sensitive materials within their facility, or "intra-site". There have been prior efforts to improve on-site transportation; however, there remains a requirement for enhanced on-site transportation at a number of facilities. The requirements for on-site transportation are driven by security, safety, and operational concerns. The Intra-site Secure Transport Vehicle (ISTV) was designed to address these concerns specifically for DOE site applications with a standardized vehicle design. This paper briefly reviews the ISTV design features providing significant enhancement of onsite transportation safety and security, and also describes the test and evaluation activities either complete of underway to validate the vehicle design and operation.

23398 (SAND–95-1273C) **Overview of criminal justice projects at Sandia National Laboratories.** Spencer, D.D. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506201–4: 11. security technology symposium and exhibitioon, Virginia Beach, VA (United States), 19-22 Jun 1995). Order Number DE95014212. Source: OSTI; NTIS; GPO Dep.

The criminal justice projects at SNL include three projects for the National Institute of Justice (smart gun, restraining foam, aqueous foam, corrections perimeter), a Southwest Border study, and one involving corrections agencies. It is concluded that the national technologies developed to protect nuclear and other high value assets have enormous potential for application to crime and personal safety; the difficulty lies in simplifying the technology transfer and making the new systems affordable.

23399 (SAND–95-1441C) **The development of a walk-through portal detector for the identification of contraband explosives.** Parmeter, J.E. (Sandia National Labs., Albuquerque, NM (United States)); Conrad, F.J.; Hannum, D.W.; Linker, K.L.; Lastoskie, C.M. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506201–5: 11. security technology symposium and exhibitioon, Virginia Beach, VA (United States), 19-22 Jun 1995). Order Number DE95014858. Source: OSTI; NTIS; GPO Dep.

Recent worldwide events have shown that explosives are the weapon of choice of terrorists in a variety of situations. For this reason, the need exists to develop a walk-through explosives detector that can be used at airports, government buildings, and other sites requiring both high security and the rapid screening of large numbers of people. In this paper, we discuss on-going efforts at Sandia to develop a walk-through explosives detection portal for the Federal Aviation Administration (FAA). We present a brief overview of detectors and detection methods currently utilized in this field, and discuss the special challenges associated with the development of portal detectors. Preliminary results obtained with the portal system at Sandia indicate that the overall portal concept is viable for the detection of contraband high explosives.

23400 (SAND–95-8649C) **Straight-Line: A nuclear material storage information management system.** Nilsen, C.; Mangan, D. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506215–1: 4. NA annual international conference on controlling arms, Philadelphia, PA (United States), 20 Jun 1995). Order Number DE95014352. Source: OSTI; NTIS; INIS; GPO Dep.

Sandia National Laboratories is developing Straight-Line – a pilot system to demonstrate comprehensive monitoring of nuclear material in storage. Straight-Line is an integrated system of sensors providing information that will enhance the safety, security, and international accountability of stored nuclear material. The goals of this effort are to: (1) Provide the right sensor information to the right user immediately. (2) Reduce the expenses, risks, and frequency of human inspection of the material. (3) Provide trustworthy data to international inspectors to minimize their need to make on

site inspections. In pursuit of these goals, Straight-Line unites technology from Sandia's Authenticated Item Monitoring System (AIMS) and other programs to communicate the authenticated status of the monitored item back to central magazine receivers. Straight-Line, however, incorporates several important features not found in previous systems: (1) Information Security – the ability to collect and safely disseminate both classified and unclassified sensor data to users on a need-to-know basis. (2) Integrate into a single system the monitoring needs of safety, security, and international accountability. (3) Incorporate the use of sensors providing analog or digital output. This paper will present the overall architecture and status of the Straight-Line project.

23401 (UCRL-ID–106454-94-4) **Lawrence Livermore National Laboratory safeguards and security quarterly progress report to the US Department of Energy quarter ending September 30, 1994.** Davis, G.; Mansur, D.L.; Ruhter, W.D.; Steele, E.; Strait, R.S. Lawrence Livermore National Lab., CA (United States). Oct 1994. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012472. Source: OSTI; NTIS; GPO Dep.

This report presents the details of the Lawrence Livermore National Laboratory safeguards and securities program. This program is focused on developing new technology, such as x- and gamma-ray spectrometry, for measurement of special nuclear materials. This program supports the Office of Safeguards and Securities in the following five areas; safeguards technology, safeguards and decision support, computer security, automated physical security, and automated visitor access control systems.

23402 (UCRL-ID–121006) **DISSS/PSDB - Personnel Security Database Modernization Project: Compilation of data gathered from DOE Operations Office's site visits.** Carpenter, R.; Sweeney, D. Lawrence Livermore National Lab., CA (United States). 15 Mar 1995. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015952. Source: OSTI; NTIS; GPO Dep.

This document is a compilation of the information gathered from visits to the DOE Operations Offices. The purpose of these visits was to gather requirements for the modernization of the personnel security database. The initial phase of visits were to sites which had known local systems to augment CPCI. They were; Rocky Flats, Richland, Las Vegas, Savannah River, Oak Ridge, and Oakland. The second phase of site visits were to; Headquarters, Schenectady, Pittsburgh, Idaho Falls, Chicago, and Albuquerque. We also visited the NRC. At each site we reviewed the current clearance process in use at the field office. If the site had a local personnel security database (PSDB), we also reviewed the current PSDB processing. Each meeting was began with the a discussion on the purpose of the meeting and the background of the redesign effort.

23403 (UCRL-JC–120593) **Regulatory issues for deep borehole plutonium disposition.** Halsey, W.G. Lawrence Livermore National Lab., CA (United States). Mar 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9503166–1: Fluor Daniel at Lawrence Livermore National Laboratory, Livermore, CA (United States), 29 Mar 1995). Order Number DE95014161. Source: OSTI; NTIS; INIS; GPO Dep.

As a result of recent changes throughout the world, a substantial inventory of excess separated plutonium is expected to result from dismantlement of US nuclear weapons. The safe and secure management and eventual disposition of this plutonium, and of a similar inventory in Russia, is a high priority. A variety of options (both interim and permanent) are under consideration to manage this material. The permanent solutions can be categorized into two broad groups: direct disposal and utilization. The deep borehole disposition concept involves placing excess plutonium deep into old stable rock formations with little free water present. Issues of concern include the regulatory, statutory and policy status of such a facility, the availability of sites with desirable characteristics and the technologies required for drilling deep holes, characterizing them, emplacing excess plutonium and sealing the holes. This white paper discusses the regulatory issues. Regulatory issues concerning construction, operation and decommissioning of the surface facility do not appear to be controversial, with existing regulations providing adequate coverage. It is in the areas of siting, licensing and long term environmental protection that current regulations may be inappropriate. This is because many current regulations are by intent or by default specific to waste forms, facilities or missions significantly different from deep borehole disposition of excess weapons usable fissile material. It is expected that custom regulations can be evolved in the context of this mission.

0560 Legislation and Regulations

Refer also to citation(s) 23403, 23561, 23562

23404 (WR-B–95-07) **Consultant subcontracting at the Idaho National Engineering Laboratory.** USDOE Office of Inspector General, Albuquerque, NM (United States). Western Regional Audit Office. 20 Jun 1995. 21p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The Department of Energy (Department), Idaho Operations Office (ID) is responsible for ensuring that its management and operating (M&O) contractors subcontract consultant services in a manner most advantageous to the Department. The objectives of the audit were to determine whether consultant subcontracts were competitively and objectively awarded and whether these subcontracts supported the Idaho National Engineering Laboratory's (INEL) mission. The audit showed that M&O contractors generally did not award consultant subcontracts competitively and objectively. Also, many of the subcontracts were awarded to former INEL employees, increasing the potential for conflicts of interest. These problems occurred because M&O contractors' internal controls did not ensure that sole source procurements were adequately justified and that potential conflicts of interest were avoided. By not competing consultant subcontracts the Department may not have obtained the most economical consultant services. Further, the fundamental fairness upon which such subcontracts were awarded to former employees was questionable. Additionally, one INEL M&O contractor was subcontracting consultant support services directly for Department Headquarters. This occurred because Headquarters elements and the M&O contractor did not follow Department guidance prohibiting subcontractual support from an M&O contractor directly to Headquarters. As a result, the M&O contractor acted as a procurement agent for Headquarters enabling Headquarters to avoid the more stringent requirements of the Department's procurement process.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Refer also to citation(s) 24937

0701 Physical Isotope Separation

Refer also to citation(s) 23410

23405 (INIS-mf–14545) **Process of advective diffusive enrichment using differential gradients and the effects of variations in relaxation times.** Suarez Antola, R. (Direccion Nacional de Tecnologia Nuclear, Montevideo (Uruguay)); Bernasconi, G.; Bertolotti, Angel. Ministerio de Industria, Energia y Mineria, Montevideo (Uruguay). Direccion Nacional de Tecnologia Nuclear. [1995]. 23p. (In Spanish). Order Number DE95632407. Source: OSTI; NTIS (US Sales Only); INIS.

A multicomponent solution is considered in advective diffusion chambers between two half-permeable barriers. A mathematical model is developed to calculate the concentration fields in the chamber. A new enrichment process is proposed and assessed using a digital simulation of space-time dynamics, based on the analytical solution of the model.

0702 Radiation Sources

Refer also to citation(s) 23405, 23883, 24988, 24989

23406 (ANL/TD/CP–85177) **Versatile neutron NDA.** DeVolpi, A. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

W-31109-ENG-38. (CONF-950787–5: 36. annual meeting of the Institute for Nuclear Materials Management, Palm Desert, CA (United States), 9-12 Jul 1995). Order Number DE95014225. Source: OSTI; NTIS; INIS; GPO Dep.

Non-destructive analysis (NDA) of bulk samples is a major tool in international safeguards and domestic MC&A. Yet, enhancements are needed to reduce inspection time, financial cost, and radiation exposure-while improving reliability and accuracy-particularly for mixtures of fissile and fertile isotopes. Perhaps the greatest remaining direction for NDA improvement is the development of a single controllable neutron source that would add versatility and capability. One of the primary prospects is a switchable radioactive neutron source (SRNS) that has been under advanced-concept development at Argonne with DOE funding. The SRNS would be in a sealed capsule that can be remotely switched on and off, or pulsed at a controllable rate. Li(α, n) or Be(α, n) reactions could give a choice of sub-threshold or hard-spectrum neutrons at yields ranging from 10^4/s to more than 10^8s. The SRNS would provide improved capabilities for (1) simultaneous or alternating interrogation with fast and slow neutrons, (2) detection of the first few seconds of delayed neutrons, (3) measurements in the presence of high neutron and/or gamma background, and (4) inspection of heterogeneous materials. When the neutrons are switched off, the source would be portable with vastly reduced shielding. Proof-of-concept with a single switchable plate has been established under laboratory conditions.

23407 (JAERI-Tech–95-013) **Pilot-scale test for electron beam flue gas treatment of coal-fired boiler.** Namba, Hideki (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research Establishment); Tokunaga, Okihiro; Hashimoto, Shoji; Tanaka, Tadashi; Ogura, Yoshimi; Doi, Yoshitaka; Aoki, Shinji; Izutsu, Masahiro. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 13p. (In Japanese). Order Number DE95789344. Source: OSTI; NTIS; INIS.

The report summarizes the results of pilot-scale test conducted from November 1992 to December 1993 in the premises of Shin-Nagoya Power Plant of Chubu Electric Power Company to establish the technology to remove SO_2 and NO_X simultaneously in dry process by electron-beam irradiation. The results are summarized as follows. (1) SO_2 and NO_X removal efficiency; The tests were conducted to prove enough SO_2 and NO_X removals for wide concentration range (SO_2 : 250-2,000ppmv, NO_X : 140-240ppmv) under the flue gas condition of O_2 10-11% in dry base and H_2O 5-6% in wet base. The electron beam method achieved higher removal performance than the target (SO_2 removal : 94%, NO_X removal : 80%) under all flue gas conditions sited above, with properly controlled absorbed dose, flue gas temperature and amount of ammonia injection. (2) Byproduct collection; More than 99% of particulate was collected by the electrostatic precipitator (ESP) with optimizing charge current and rapping cycle of ESP. Particulate concentration at the outlet of the bag filter installed downstream of ESP was as low as 0.1-0.4mg/m^{3}N. It is expected that particulate concentration at ESP outlet could be reduced to the level of 5mg/m^{3}N with increased collecting plate-area of ESP even without bag filter. (3) Controllability and reliability of equipment; The performance, controllability, reliability, and durability of the system were confirmed through the test operation using the same flue gas cooling system, electron beam voltage, structure and cooling system of window foils as those of actual scale plant. (4) Quality of byproduct; It was proved that the byproduct had excellent quality as same as that of nitrogenous fertilizers on market with the result of chemical analysis and plant growth test. The byproduct was officially registered as an agricultural fertilizer under the Fertilizer Control Act in Japan. (author).

23408 (ORNL/M–3774) **Assessment of the roles of the Advanced Neutron Source Operators.** Hill, W.E.; Houser, M.M.; Knee, H.E.; Spelt, P.F. Oak Ridge National Lab., TN (United States). Mar 1995. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012535. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Neutron Source (ANS) is unique in the extent to which human factors engineering (HFE) principles are being applied at the conceptual design stage. initial HFE accomplishments include the development of an ANS HFE program plan, operating philosophy, and functional analysis. In FY 1994, HFE activities focused on the role of the ANS control room reactor operator (RO). An operator-centered control room model was used in conjunction with information gathered from existing ANS system design descriptions and other literature to define a list of RO responsibilities. From this list, a survey instrument was developed and administered to ANS design engineers, operations management personnel at Oak Ridge National Laboratory's High Flux Isotope Reactor (HFIR), and HFIR ROs to detail the nature of the RO position. Initial results indicated that the RO will function as a high-level system supervisor with considerable monitoring, verification, and communication responsibilities. The relatively high level of control automation has resulted in a reshaping of the RO's traditional safety and investment protection roles.

0705 Health and Safety

23409 (NUREG–0090-Vol.18-No.1) **Report to Congress on abnormal occurrences, January–March 1995. Volume 18, No. 1.** Nuclear Regulatory Commission, Washington, DC (United States). Office for Analysis and Evaluation of Operational Data. Jul 1995. 21p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence (AO) as an unscheduled incident or event that the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such occurrences to be made to Congress. This report provides a description of those incidents and events that have been determined to be AOs during the period of January 1 through March 31, 1995. This report addresses one AO at an NRC-licensed facility which involved a medical brachytherapy misadministration. The report also contains updates of one AO previously reported by an NRC licensee and three AOs previously reported by the Agreement States. No "Other Events of Interest" items are being reported.

23410 (ORNL/ER–230) **Project management plan for the Isotopes Facilities Deactivation Project at Oak Ridge National Laboratory. Environmental Restoration Program.** Oak Ridge National Lab., TN (United States). [1995]. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95008963. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the Isotopes Facilities Deactivation Project (IFDP) is to place nineteen former isotopes production facilities at the Oak Ridge National Laboratory in a safe, stable, and environmentally sound condition suitable for an extended period of minimum surveillance and maintenance (S&M) and as quickly and economically as possible. Implementation and completion of the deactivation project win further reduce the already small risks to the environment and to public safety and health. Furthermore, the project should result in significant S&M cost savings in the future. The IFDP management plan has been prepared to document the project objectives, define organizational relationships and responsibilities, and outline the management control systems to be employed in the management of the project. The project has adopted a strategy to deactivate the simple facilities first, to reduce the scope of the project, and to gain experience before addressing more difficult facilities. A decision support system is being developed to identify those activities that best promote the project mission and result in largest cost savings. The Work Plan for the Isotopes Facilities Deactivation Project at Oak Ridge National Laboratory (Energy Systems 1994) defines the project schedule, the cost estimate, and the technical approach for the project.

23411 (PNL–10620) **Tritium radioluminescent devices, Health and Safety Manual.** Traub, R.J.; Jensen, G.A. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015815. Source: OSTI; NTIS; INIS; GPO Dep.

This document consolidates available information on the properties of tritium, including its environmental chemistry, its health physics, and safe practices in using tritium-activated RL lighting. It also summarizes relevant government regulations on RL lighting.

Chapters are divided into a single-column part, which provides an overview of the topic for readers simply requiring guidance on the safety of tritium RL lighting, and a dual-column part for readers requiring more technical and detailed information.

0706 Environmental Aspects

23412 (DOE/SR/15199–7) **Annual review of cultural resource investigations by the Savannah River Archaeological Research Program. Fiscal year 1994.** South Carolina Univ., Columbia, SC (United States). Savannah River Archaeological Research Program. Oct 1994. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC09-88SR15199. Order Number DE95014322. Source: OSTI; NTIS; GPO Dep.

The Savannah River Archaeological Research Program (SRARP) of the South Carolina Institute of Archaeology and Anthropology, University of South Carolina, manages archaeological resources on the Savannah River Site (SRS). An ongoing research program provides the theoretical, methodological, and empirical basis for assessing site significance within the compliance process specified by law. The SRARP maintains an active public education program for disseminating knowledge about prehistory and history, and for enhancing awareness of historic preservation. This report summarizes the management, research, and public education activities of the SRARP during Fiscal Year 1994.

08 HYDROGEN

Refer also to citation(s) 23824

23413 (DOE/GO–10095-179) **The green hydrogen report. The 1995 progress report of the Secretary of Energy's Hydrogen Technical Advisory Panel.** National Renewable Energy Lab., Golden, CO (United States). [1995]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009213. Source: OSTI; NTIS; GPO Dep.

This report presents the idea that hydrogen and electricity, ultimately derived from renewable technologies, will serve as the clean, inexhaustible energy carriers in the next century. The widespread introduction of these energy forms would dramatically reduce the nation's air pollution, enhance its energy security, and ameliorate potential global climate problems. The topics of the report include the role of hydrogen, research priorities, and use of hydrogen in surface transportation and aircraft.

0801 Production

Refer also to citation(s) 22986, 23718

23414 (DOE/GO/10039–1) **Solar powered hydrogen generating facility and hydrogen powered vehicle fleet. Technical progress report, August 11, 1994–September 30, 1994.** Provenzano, J.J. Clean Air Now, Venice, CA (United States). Nov 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC36-94GO10039. Order Number DE95009192. Source: OSTI; NTIS; GPO Dep.

The progress of the project is updated.

0804 Economic, Industrial, and Business Aspects

Refer also to citation(s) 23486

0830 Combustion

Refer also to citation(s) 23810

23415 (LA-UR–95-1466) **Hydrogen program combustion research: Three dimensional computational modeling.** Johnson, N.L.; Amsden, A.A.; Butler, T.D. Los Alamos National Lab., NM (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9504160–1: 1995 DOE/NREL hydrogen program review, Coral Gables, FL (United States), 18-21 Apr 1995). Order Number DE95011997. Source: OSTI; NTIS; GPO Dep.

We have significantly increased our computational modeling capability by the addition of a vertical valve model in KIVA-3, code used internationally for engine design. In this report the implementation and application of the valve model is described. The model is shown to reproduce the experimentally verified intake flow problem examined by Hessel. Furthermore, the sensitivity and performance of the model is examined for the geometry and conditions of the hydrogen-fueled Onan engine in development at Sandia National Laboratory. Overall the valve model is shown to have comparable accuracy as the general flow simulation capability in KIVA-3, which has been well validated by past comparisons to experiments. In the exploratory simulations of the Onan engine, the standard use of the single kinetic reaction for hydrogen oxidation was found to be inadequate for modeling the hydrogen combustion because of its inability to describe both the observed laminar flame speed and the absence of autoignition in the Onan engine. We propose a temporary solution that inhibits the autoignition without sacrificing the ability to model spark ignition. In the absence of experimental data on the Onan engine, a computational investigation was undertaken to evaluate the importance of modeling the intake flow on the combustion and NO_x emissions. A simulation that began with the compression of a quiescent hydrogen-air mixture was compared to a simulation of the full induction process with resolved opening and closing of the intake valve. Although minor differences were observed in the cylinder-averaged pressure, temperature, bulk-flow kinetic energy and turbulent kinetic energy, large differences where observed in the hydrogen combustion rate and NO_x emissions. The flow state at combustion is highly heterogeneous and sensitive to the details of the bulk and turbulent flow and that an accurate simulation of the Onan engine must include the modeling of the air-fuel induction.

23416 (UCRL-JC–120677) **Detailed and global chemical kinetics model for hydrogen.** Marinov, N.M.; Westbrook, C.K.; Pitz, W.J. Lawrence Livermore National Lab., CA (United States). Mar 1995. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9510158–1: 8. international symposium on transport properties, San Francisco, CA (United States), Oct 1995). Order Number DE95013439. Source: OSTI; NTIS; GPO Dep.

Detailed and global chemical kinetic computations for hydrogen-air mixtures have been performed to describe flame propagation, flame structure and ignition phenomena. Simulations of laminar flame speeds, flame compositions and shock tube ignition delay times have been successfully performed. Sensitivity analysis was applied to determine the governing rate-controlling reactions for the experimental data sets examined. In the flame propagation and structure studies, the reactions, $OH + H_2 = H_20 + H$, $0 + H_2 = OH + H$ and $0 + OH = 0_2 + H$ were the most important in flames. The shock tube ignition delay time study indicated the $H + 0_2 + M = H0_2 + M$ ($M = N_2, H_2$) and $0 + OH = 0_2 + H$ reactions controlled ignition. A global rate expression for a one-step overall reaction was developed and validated against experimental hydrogen-air laminar flame speed data. The global reaction expression was determined to be $1.8 \times 10^{13} \exp(-17614K/T)[H_2]^{1.0}[O_2]^{0.5}$ for the single step reaction $H_2 + 1/2O_2 = H_2O$.

09 BIOMASS FUELS

0908 Production

Refer also to citation(s) 23431

23417 (DOE/CE/15544–T11) **Develop a field grid system for yield mapping and machine control. Quarterly report, April 1, 1995–June 30, 1995.** Froehlich, D.P.; Schumacher, J.A. South Dakota State Univ., Brookings, SD (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-92CE15544. Order Number DE95013820. Source: OSTI; NTIS; GPO Dep.

The operation of the patented hardware/software Field Grid Sense (FGS) system is being tested in crop harvesting in order to demonstrate the systems's utility and to analyze the flexibility of operation under true field conditions. FGS is also being used with

chemical application equipment. This action will create improved systems and establish the worthiness, efficiency and necessity of chemical application equipment that is controlled and directed via the FGS package.

23418 (DOE/ER/14059–T1) **Hemicellulases from anaerobic thermophiles. Progress report.** Wiegel, J. Georgia Univ., Athens, GA (United States). Research Foundation. May 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-89ER14059. Order Number DE95015475. Source: OSTI; NTIS; GPO Dep.

The longterm goal of this research effort is to obtain an anaerobic thermophilic bacterium that efficiently converts various hemicellulose-containing biomass to ethanol over a broad pH range. The strategy is to modify the outfit and regulation of the rate-limiting xylanases, glycosidases and xylan esterases in the ethanologenic, anaerobic thermophile Thermoanaerobacter ethanolicus, which grows between pH 4.5 and 9.5. Although it utilizes xylans, the xylanase, acetyl(xylan) esterase and O-methylglucuronidase activities in T. ethanolicus are barely measurable and regarded as the rate limiting steps in its xylan utilization. Thus, and also due to the presently limited knowledge of hemicellulases in anaerobic thermophiles, we characterize the hemicellulolytic enzymes from this and other anaerobic thermophiles as enzyme donors. Beside the active xylosidase/arabinosidase from T. ethanolicus, exhibiting the two different activities, we characterized 2 xylosidases, two acetyl(xylan) esterases, and an O-methylglucuronidase from Thermoanaerobacterium spec. We will continue with the characterization of xylanases from novel isolated slightly acidophilic, neutrophilic and slightly alkalophilic thermophiles. We have cloned, subcloned and partially sequenced the 165,000 Da (2 x 85,000) xylosidase/arabinosidase from T. ethanolicus and started with the cloning of the esterases from Thermoanaerobacterium spec. Consequently, we will develop a shuttle vector and continue to apply electroporation of autoplasts as a method for cloning into T. ethanolicus.

0909 Processing

23419 (DOE/ER/13614–T3) **Microbiology and physiology of anaerobic fermentation of cellulose. Annual report for 1990, 1992, 1993 and final report.** Ljungdahl, L.G.; Wiegel, J.; Peck, H.D. Jr.; Mortenson, L.E. Georgia Univ., Athens, GA (United States). Research Foundation. 31 Aug 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-86ER13614. Order Number DE95006423. Source: OSTI; NTIS; GPO Dep.

This report focuses on the bioconversion of cellulose to methane by various anaerobes. The structure and enzymatic activity of cellulosome and polycellulosome was studied in Clostridium thermocellum. The extracellular enzymes involved in the degradation of plant material and the physiology of fermentation was investigated in anaerobic fungi. Enzymes dealing with CO, CO_2, H_2, CH_3OH, as well as electron transport and energy generation coupled to the acetyl-CoA autotrophic pathway was studied in acetogenic clostridia.

23420 (DOE/ER/13614–T4) **Microbiology and physiology of anaerobic fermentation of cellulose. Progress report (4/30/91–4/30/92) and outline of work for the period 9/1/92–9/1/93.** Ljungdahl, L.G. Georgia Univ., Athens, GA (United States). Research Foundation. [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-86ER13614. Order Number DE95008038. Source: OSTI; NTIS; GPO Dep.

The authors are continuing their efforts to partly dissociate the cellulolytic enzyme complex of C. thermocellum. This complex named cellulosome (also existing as polycellulosome) consists of perhaps as many as 26 different subunits. It is extremely resistant to dissociation and denaturation. Treatments with urea and SDS have little effect unless the latter treatment is at high temperature. Significantly, some of the subunits after SDS dissociation have CMCase (endoglucanase) activity but no activity toward crystalline cellulose. The only reported success of hydrolysis of crystalline cellulose by cellulosomal subunits is by Wu et al. who isolated two protein fractions labeled SL and SS which when combined exhibit a low (about 1% of the original cellulosome) activity toward crystalline cellulose. The long standing goal is still to determine the activities of the individual subunits, to characterize them, to find out how they are associated in the cellulosome, and to establish the minimum number of subunits needed for efficient hydrolysis of crystalline cellulose. This report also presents the results of experiments on cellulose hydrolysis in aerobic fungi, as well as other anaerobic bacteria.

23421 (DOE/ER/13712–4) **Molecular genetics of ligninase expression. Progress report.** Cullen, D. (Univ. of Wisconsin, Madison, WI (United States). Dept. of Bacteriology). Wisconsin Univ., Madison, WI (United States). Dept. of Plant Pathology. [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13712. Order Number DE95013811. Source: OSTI; NTIS; GPO Dep.

The objectives of this research for the past three years have been to (1) elucidate the structure and genomic organization of genes involved in lignin degradation; and (2) investigate the expression of these genes in Phanerochaete chrysosporium and in heterologous hosts. Major accomplishments include the following: (1) the P. chrysosporium gene encoding glyoxal oxidase has been cloned, sequenced, and efficiently expressed in Aspergillus; (2) mapping methods were developed allowing the integration of genetic and physical maps of P. chrysosporium; (3) highly specific and sensitive PCR techniques were developed for discriminating closely related mRNAs. Application of this technique will help to identify specific genes involved in degradation of lignin and organopollutants; (4) investigations have revealed a novel insertional mutation in lignin peroxidase gene lipI.

23422 (DOE/ER/14059–2) **The hemicellulases from the ethanologenic thermophile, Thermoanaerobacter ethanolicus and similar anaerobic thermophiles. Annual technical progress report.** Wiegel, J. Georgia Univ., Athens, GA (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-89ER14059. Order Number DE95014706. Source: OSTI; NTIS; GPO Dep.

A Xylanase was fractionated from Thermoanaerobacter ethanolicus, an ethanologenic thermophile, and the preparation so obtained was used to determined enzymatic parameters such as pH profile of enzyme activity. The ability of various mono- and di-saccharides as well as temperature variations to induce this enzyme activity were studied.

23423 (DOE/R4/10591–1) **Intermediate-scale high-solids anaerobic digestion system operational development.** Rivard, C.J. National Renewable Energy Lab., Golden, CO (United States). Feb 1995. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG44-91R410591. Order Number DE95009646. Source: OSTI; NTIS; GPO Dep.

Anaerobic bioconversion of solid organic wastes represents a disposal option in which two useful products may be produced, including a medium Btu fuel gas (biogas) and a compost-quality organic residue. The application of high-solids technology may offer several advantages over conventional low-solids digester technology. Operation of the anaerobic digestion process at high solids reduces the level of process water and thereby the size and capital costs for the digester system. In addition, by virtue of the lack of available water, the microbial catalysts are more productive in feedstock polymer hydrolysis. The National Renewable Energy Laboratory (NREL) has developed a unique digester system capable of uniformly mixing high-solids materials at low cost. Information gained from laboratory-scale digester research was used to develop die intermediate-scale digester system. This system represents a 50-fold scale-up of the original digester system and includes continuous feed addition and computer monitoring and control. During the first 1.15 years of operation, a variety of modifications and improvements were instituted to increase the safety, reliability, and performance of the system. Those improvements – which may be critical in further scale-up efforts using the NREL high-solids digester design – are detailed in this report.

23424 (ETDE-DE–155) **Power generation from biomass. Agricultural, technical and economic aspects.** Akademie fuer

Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 43. Flaig, H.; Lueneburg, E. von; Ortmaier, E.; Seeger, C. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Feb 1995. 140p. (In German). Order Number DE95790380. Source: OSTI; NTIS (US Sales Only).

The report discusses power generation from biomass. Plants for wood and straw combustion are described under the aspect of environmental protection. The environmental impact of power generation from biomass is discussed as well as economic and logistic aspects. (orig.)

23425 (ETDE-DE–156) **Climate-compatible power supply in Baden-Wuerttemberg - energy from agricultural and forestry biomass.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 16. Flaig, H. (Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Bereich Biotechnologie, Oekologie, Gesundheit); Linckh, G.; Mohr, H. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Feb 1995. 89p. (In German). Order Number DE95790252. Source: OSTI; NTIS (US Sales Only).

The report investigates the use of solid fuels such as straw and wood and of rapeseed oil and biogas for power generation. In each case, it presents the state of the art, the technological potentiall, the cost of installing plants of this type, and the impact on the environment (carbon dioxide emission), society, and agriculture. (SR)

23426 (NREL/TP–431-7971) **Progress in the production of hot-gas filtered biocrude oil at NREL.** Diebold, J.P.; Scahill, J.W.; Czernik, S.; Phillips, S.D.; Feik, C.J. National Renewable Energy Lab., Golden, CO (United States). May 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009245. Source: OSTI; NTIS; GPO Dep.

Progress in the production of hot-gas filtered biocrude oils from a dry hybrid poplar feedstock in the NREL vortex ablative pyrolysis reactor is discussed. In particular, adjusting the pyrolysis severity in the vortex reactor and the cracking severity in the char baghouse resulted in increased oil yields of very low-ash and low-alkali biocrude oils. The viscosity of these oils meets the requirements for American Society for Testing and Materials (ASTM) No.4 fuel oils. Increasing the water content to 30% decreased the viscosity by half, but not enough to meet the viscosity requirement for ASTM No.2 fuel oil. Viscosity contours for water and methanol dilution are shown. The addition of water or methanol or both to make a more consistent product may be advantageous. Aging studies of this low-alkali oil showed a slower increase in viscosity with time equal to one-third the rate of a biocrude oil with higher alkali contents. It appears that removal of the char fines results in a more stable oil. In fact, after 24 hours at 90 C, the viscosity of this low-ash biocrude oil was lower than that seen previously for the unaged sample of higher ash oil. It is concluded that the removal of char fines to produce a premium biocrude oil will be even more important than was previously supposed.

23427 (NYSERDA–95-9) **Integrated process for microbial solvent production from whey permeate. Final report.** New York State Energy Research and Development Authority, Albany, NY (United States); Cornell Univ., Ithaca, NY (United States). Dept. of Agricultural and Biological Engineering. Jun 1995. 45p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223 (United States).

Acetone and butanol were historically produced through fermentation of carbohydrate raw materials. Conventional feedstocks such as grain and molasses, and the energy required to recover products by distillation, are too costly for traditional batch fermentation to compete with petrochemical synthesis. The authors proposed to evaluate an acetone-butanol-ethanol fermentation of acid whey permeate, a cheap carbohydrate source, using up-to-date bioreactor technology continuous fermentation with cell recycle and in-situ butanol recovery by gas stripping. Clostridium acetobutylicum P262 was the strain chosen, as it assimilates both the lactose and lactic acid in acid whey. Single-stage continuous culture proved unsuitable for butanol production, since productivity is low and cultures degenerated quickly. Two-stage culture improved productivity by a factor of two over batch runs. All continuous cultures showed major oscillations in cell density, substrate concentration and products formed. Under these conditions, cell recycle did not affect productivity in two-stage culture. Gas stripping with fermentor off-gases recovered a clean condensate of butanol and acetone at 70–90% yield and with purification factors of 14 to 35. Stripping maintained solvent concentrations in the range of 2–4 g/l even at the peak of solventogenesis, eliminating product inhibition. Gas stripping produced a 50% improvement in substrate uptake and a 10–20% improvement in solvent productivity.

0910 Properties and Composition

23428 (NREL/TP–433-7965) **An atlas of thermal data for biomass and other fuels.** Gaur, S. (Colorado School of Mines, Golden, CO (United States)); Reed, T.B. National Renewable Energy Lab., Golden, CO (United States). Jun 1995. 189p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009212. Source: OSTI; NTIS; GPO Dep.

Biomass is recognized as a major source of renewable energy. In order to convert biomass energy to more useful forms, it is necessary to have accurate scientific data on the thermal properties of biomass. This Atlas has been written to supply a uniform source of that information. In the last few decades Thermal analysis (TA) tools such as thermogravimetry, differential thermal analysis, thermo mechanical analysis, etc. have become more important. The data obtained from these techniques can provide useful information in terms of reaction mechanism, kinetic parameters, thermal stability, phase transformation, heat of reaction, etc. for gas-solid and gas-liquid systems. Unfortunately, there are no ASTM standards set for the collection of these types of data using TA techniques and therefore, different investigators use different conditions which suit their requirements for measuring this thermal data. As a result, the information obtained from different laboratories is not comparable. This Atlas provides the ability to compare new laboratory results with a wide variety of related data available in the literature and helps ensure consistency in using these data.

23429 (PNL-SA–24295) **Chemical analysis of biomass fast pyrolysis oils.** Elliott, D.C. Pacific Northwest Lab., Richland, WA (United States). Sep 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9409224–2: Biomass pyrolysis oil properties and combustion meeting, Estes Park, CO (United States), 26-28 Sep 1994). Order Number DE95014616. Source: OSTI; NTIS; GPO Dep.

This paper reviews the development of the field of chemical analysis of biomass fast pyrolysis oils. The techniques applied to pyrolysis oil analysis are reviewed including proximate and ultimate analysis, water (moisture) analysis, and chemical component analysis by various forms of chromatography, solvent separations, and spectrophotometric analyses, like infrared and ultraviolet. Advanced analytical techniques such as nuclear magnetic resonance and molecular beam – mass spectrometry are also discussed. This paper reviews and compares the methods and the results of the analyses. The advantages and shortcomings of the various methods applied are identified. Comparisons derived from the IEA Round Robin are incorporated.

0930 Economic, Industrial, and Business Aspects

23430 (CONF-9410357–1) **Production costs and supply of biomass by U.S. Region.** Walsh, M. Oak Ridge National Lab., TN (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Iowa's pursuit of energy efficiency conference; Des Moines, IA (United States); 25-26 Oct 1994. Order Number DE95013985. Source: OSTI; NTIS; GPO Dep.

The Biofuels Feedstock Development Program has attempted to estimate the cost of producing dedicated energy crops for several regions of the United States. Switchgrass and hybrid poplar have been chosen as representative herbaceous and woody crop species for the estimation. A full economic cost accounting approach is used. This means that not only are out-of-pocket cash

expenses (e.g. fertilizers, chemicals, seeds, fuel, repairs) estimated, but fixed costs (e.g., overhead, taxes) and the costs of owned resources (e.g., producer's own labor, equipment depreciation, land values) are also estimated as part of the cost of producing dedicated energy crops. The costs are estimated as enterprise budgets which means that costs of producing energy crops are estimated as separate entities, and not estimated in context of the entire farm management structure. Competitiveness of energy crops with conventional crops vary by region. Breakeven prices are regional averages. Breakeven prices for poplar are higher than for switchgrass in all regions, in large part due to the higher cost of producing poplars.

23431 (ORNL–6858) **Potential supply and cost of biomass from energy crops in the TVA region.** Graham, R.L.; Downing, M.E. Oak Ridge National Lab., TN (United States). Apr 1995. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011623. Source: OSTI; NTIS; GPO Dep.

The economic and supply structures of energy crop markets have not been established. Establishing the likely price and supply of energy crop biomass in a region is a complex task because biomass is not an established commodity as are oil, natural gas, and coal. In this study, the cost and supply of short-rotation woody crop (SRWC) and switchgrass biomass for the Tennessee Valley Authority (TVA) region-a 276-county area that includes portions of 11 states in the southeastern United States - are projected. Projected prices and quantities of biomass are assumed to be a function of the amount and quality of crop and pasture land available in a region, expected energy crop yields and production costs on differing soils and land types, and the profit that could be obtained from current conventional crop production on these same lands. Results include the supply curves of SRWC and switchgrass biomass that are projected to be available from the entire region, the amount and location of crop and pasture land that would be used, and the conventional agricultural crops that would be displaced as a function of energy crop production. Finally, the results of sensitivity analysis on the projected cost and supply of energy crop biomass are shown. In particular, the separate impacts of varying energy crop production costs and yields, and interest rates are examined.

10 SYNTHETIC FUELS

Refer also to citation(s) 23120

23432 (ETDE/JP-mf–95790778) **Report of the fiscal 1993 liquid fuel conversion technology development. Development for Practical application of a new production process.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1994. 165p. (In Japanese). Order Number DE95790778. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

The development for practical application of a new production process is made to reduce cost of fuel-use methanol. In the new vapor-phase fluidized bed method, used is a heat exchange type combined reforming furnace where steam reforming and partial oxidation are integrated into one tower in production of synthesis gas (CO, CO2, H2) from natural gas. Part of natural gas is reacted with the oxygen supplied, and using the reaction heat, the remaining natural gas is reformed. For methanol synthesis, a vapor-phase fluidized bed reactor is developed, catalyst particles are fluidized, and reaction heat is recovered as high-temperature steam. In the new production process, increase in plant size and efficiency can be made, and various combinations can be made of the reforming method and the methanol synthesis method. The new production process brings reduction in construction cost, improvement in energy unit requirement, and energy saving. In fiscal 1993, study was made on fluidized bed catalyst, unit process and its optimization, etc. Further, conceptual design was made on high efficiency which is more than 90% in single pass conversion ratio to methanol at 150°C and under less than 30 atm, and an economical low-temperature liquid phase method. 7 refs., 94 figs., 22 tabs.

1002 Production

Refer also to citation(s) 22991, 22992, 22996, 22998

23433 (DOE/MC/29228–4070) **Selective methane oxidation over promoted oxide catalysts. Quarterly report, December 1994–February 1995.** Klier, K.; Herman, R.; Shi, Chunlei; Wang, Chaun-Bao; Sun, Qun. Lehigh Univ., Bethlehem, PA (United States). Mar 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-92MC29228. Order Number DE95009716. Source: OSTI; NTIS; GPO Dep.

The objective of this research is the selective oxidative coupling of methane to C_2 hydrocarbons and oxygenates, in particular formaldehyde and methanol. Air, oxygen, or carbon dioxide, rather than nitrous oxide will be utilized as the oxidizing gas at high gas hourly space velocity, but mild reaction conditions (500–700°C, 1 atm total pressure). All the investigated processes are catalytic, aiming at minimizing gas phase reactions that are difficult to control. In order to optimize oxygenate space time yields over supported vanadium catalysts, testing of catalysts with various vanadium contents was carried out during this quarter. The highest oxygenate productivity from CH_4/air/steam reactants that has been observed so far was achieved with the 2.0 wt % catalyst. The effects of steam on activity and selectivity were explored in more detail over a 2 wt % V_2O_5/SiO_2 catalyst prepared by impregnation of a methanol solution of vanadium(V) triisopropoxide oxide and amorphous silica. An interesting observation was that the HCHO space time yields were not significantly affected by increasing steam in the feed while those of methanol were, which indicated that the two oxygenates may be formed by separate pathways on the surface. Experiments were carried out in which the 1 wt % $SO_4^{2-}/Sr/La_2O_3$ and 1 wt % V_2O_5/SiO_2 catalysts were physically mixed (mixed bed) instead of one lying on top of the other (double bed). With the mixed bed, the total oxygenate space time yields decreased and the HCHO space time yields dropped to virtually zero. However, the space time yields of methanol were still significant.

23434 (DOE/MC/60249–95/C0486) **The synthesis and characterization of new iron coordination complexes utilizing an asymmetric coordinating chelate ligand.** Watkins, B.E.; Satcher, J.H. Lawrence Livermore National Lab., CA (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950494–31: Natural gas research, development and demonstration contractors review meeting, Baton Rouge, LA (United States), 4-6 Apr 1995). Order Number DE95015004. Source: OSTI; NTIS; GPO Dep.

A binuclear, unsymmetric coordinating ligand that is an effective metal chelator has been designed and synthesized. The new ligand has been shown to react readily with iron(II)/(III) forming a variety of coordination complexes. The binuclear complexes are of significant interest since they represent proof-of-principle for the development of coordinatively asymmetric, binuclear metal chelate compounds. Although this structural type of chelator now appears to be common in biological systems, it has not been previously described for inorganic coordination chemistry. The isolation of oxidation products will be helpful in establishing reaction mechanism(s) of these complexes with molecular oxygen. It is expected that this ligand and derivatives of it will play an important role in the development of bioinorganic complexes that aim to mimic enzyme active sites that function by substrate interaction at only one metal site of a multimetal active site.

23435 (DOE/PC/90011–T1) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 1, October 16, 1986–January 15, 1987.** Wilson, R.B. Jr.; Chan, Yee Wai. SRI International, Menlo Park, CA (United States). 23 Feb 1987. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014801. Source: OSTI; NTIS; GPO Dep.

The United States will need to be able to convert coal to liquid fuels should current supplies be interrupted. The indirect method for producing fuel liquids is the gasification of the coal to synthesis gas (syngas) followed by Fischer-Tropsch synthesis to convert syngas to hydrocarbons. However, both the gasifier and the FTS processes result in the production of methane and/or light hydrocarbon by-product that negatively affect the economics of the

production of liquid fuel from coal. The goal of SRI's research is thus to develop catalysts that directly convert methane and light hydrocarbons to intermediates that can, as economics dictate, be subsequently converted either to liquid fuels or value-added chemicals. SRI project 2678 is exploring two approaches to achieving the stated goal. The first approach consists of developing advanced catalysts for reforming methane. We will prepare the catalysts by reacting organometallic complexes of transition metals (Fe, Ru, Rh, and Re) with zeolitic and rare earth exchanged zeolitic supports to produce surfaceconfined metal complexes in the zeolite pores. We will then decompose the organometallic complexes to obtain very stable, highly dispersed catalysts. Our second approach entails synthesizing the porphyrin and phthalocyanine complexes of Cr, Mn, Ru, Fe, and/or Co within the pores of zeolitic supports for use as selective oxidation catalysts for methane and light hydrocarbons. We will test the catalysts in a fixed-bed isothermal microreactor in a downflow mode at ~100 psi. During the first quarter of this project, we have concentrated on methane oxidation to methanol. We have synthesized phthalocyanine oxidation catalysts containing different metals (Co, Fe, and Ru) within zeolite pores. our examination of their ability to oxidize methane to methanol has indicated preliminary positive results.

23436 (DOE/PC/90011–T2) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 2, January 16, 1987–April 15, 1987.** Wilson, R.B. Jr.; Chan, Yee Wai. SRI International, Menlo Park, CA (United States). 21 May 1987. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014802. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop catalysts that directly convert methane and light hydrocarbons to intermediates that can, as economics dictate, be subsequently converted either to liquid fuels or value-added chemicals. In this program we are exploring two approaches to developing such catalysts. The first approach consists of developing advanced catalysts for reforming methane. We will prepare the catalysts by reacting organometallic complexes of transition metals (Fe, Ru, Rh, and Re) with zeolitic and rare-earth-exchanged zeolitic supports to produce surfaceconfined metal complexes in the zeolite pores. Our second approach entails synthesizing the porphyrin and phthalocyanine complexes of Cr, Mn, Ru, Fe, and/or Co within the pores of zeolitic supports for use as selective oxidation catalysts for methane and light hydrocarbons. During the second quarter of this project, we concentrated on methane reforming. Two ruthenium clusters (Ru_4 and Ru_6) supported on three types of support materials (β-alumina, 5 Å molecular sieves, and γ-zeolite) were tested for methane reforming. The effects of cluster size, supporting material, and reaction conditions were evaluated. The methane conversions range from 1.74 to 10.11% at 750°C. The reaction product contains hydrogen, C_2 hydrocarbons, and C_6 or higher hydrocarbons. Up to 48.34% yield of hydrocarbon (C_2+) is obtained based on reacted methane. Some of these catalysts show very good coking resistance compared with a commercial ruthenium catalyst. Addition of oxygen to these reactions significantly increases the percent methane conversion at lower reaction temperature. However, carbon dioxide and water are the major products in the presence of oxygen.

23437 (DOE/PC/90011–T3) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 3, April 16–July 15, 1987.** Wilson, R.B. Jr.; Chan, Yee Wai. SRI International, Menlo Park, CA (United States). 28 Aug 1987. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014803. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop catalysts that directly convert methane and light hydrocarbons to intermediates that can, as economics dictate, be subsequently converted either to liquid fuels or value-added chemicals. In this program we are exploring two approaches to developing such catalysts. The first approach consists of developing advanced catalysts for reforming methane. We will prepare the catalysts by reacting organometallic complexes of transition metals (Fe, Ru, Rh, and Re) with zeolitic and rare-earth-exchanged zeolitic supports to produce surface-confined metal complexes in the zeolite pores. Our second approach entails synthesizing the porphyrin and phthalocyanine complexes of Cr, Mn, Ru, Fe, and/or Co within the pores of zeolitic supports for use as selective oxidation catalysts for methane and light hydrocarbons. During this reporting period, we concentrated on synthesizing and testing methane oxidation catalysts using the automated GC sampling system. We modified our preparation method of zeolite-encapsulated phthalocyanines (PC). The catalysts have higher complex loading, and the uncomplexed metal ions were back-exchanged by sodium ions (to remove any uncomplexed metal ions). Four metal ions were used: cobalt, iron, ruthenium, and manganese. We also synthesized four zeolite-encapsulated tetraphenylporphyrin (TPP) complexes using the same metals. These catalysts were tested for methane oxidation in the temperature range from 300° to 500°C at 50 psig pressure. The RUPC, COTPP, and MNTPP showed activity toward the formation of methanol. The RUPC zeolite gave the best methanol yield. The methane conversion was 4.8%, and the selectivity to methanol is 11.3% at 375°C. Again, the major products are carbon dioxide and water in every catalyst we tested during this reporting period.

23438 (DOE/PC/90011–T4) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 4, August 16–October 15, 1987.** Wilson, R.B. Jr.; Chan, Yee Wai. SRI International, Menlo Park, CA (United States). 19 Nov 1987. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014804. Source: OSTI; NTIS; GPO Dep.

The goals of this research project are to increase the methane conversion and improve the hydrocarbon production. For methane reforming, we achieved a conversion of up to 43% by adjusting the reaction conditions. Ruthenium clusters are effective catalysts but the selectivity to hydrocarbons needs to be improved. In evaluating the effect of cluster size for mononuclear, tetranuclear, and hexanuclear ruthenium complexes we found that the tetraruthenium cluster was by far the most effective catalyst. We began to study the mixed metal catalysts by synthesizing a $FeRu_3$ cluster. We plan to vary the ratio of Fe to Ru by synthesizing Fe_2Ru_2 and Fe_3Ru clusters. The type of the support also plays an important role in methane reforming. We briefly tested a basic support, magnesia, in addition to the acidic supports tested previously (alumina, 5A molecular sieve, and Y-zeolite). The results are promising. We will continue to investigate the role of the support. The effectiveness of using a hydrogen removal membrane is still in question. We purchased a new Pd/Ag membrane tube inside which a stainless steel spring is inserted. The steel spring will increase the strength of the otherwise fragile tube and it will support the tube during bending. We will build a new reactor using this membrane tube.

23439 (DOE/PC/90011–T5) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 5, November 16, 1987–January 15, 1988.** Wilson, R.B. Jr.; Chan Yee Wai. SRI International, Menlo Park, CA (United States). 5 Feb 1988. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014805. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop catalysts that directly convert methane and light hydrocarbons to intermediates that later can be converted to either liquid fuels or value-added chemicals, as economics dictate. During this reporting period, we have synthesized and tested several novel catalysts for methane reforming (Tasks 1 and 2) and for partial oxidation of methane (Tasks 3 and 4). We started to test a mixed metal system, an $FeRu_3$ cluster. This catalyst was supported both on zeolite and on magnesium oxide and the systems were tested for methane reforming at various reaction temperatures. We also prepared and tested a monomeric ruthenium catalyst supported on magnesium oxide. We found that methane is activated at a lower temperature with the basic magnesium oxide support than with acidic supports such as zeolite or alumina. Methane conversions increased with temperature, but the production of coke also increased. We prepared a sterically hindered ruthenium porphyrin encapsulated in a zeolite supercage for catalysis of methane oxidation. The results showed that only carbon dioxide was produced. Addition of axial base to this catalyst gave similar results. Another type of catalyst, cobalt Schiff base complexes, was also prepared and tested for methane oxidation. In

this case, no methane conversion was observed at temperatures ranging from 200 to 450°C. These complexes do not appear to be stable under the reaction conditions.

23440 (DOE/PC/90011–T6) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 6, January 16, 1988–April 15, 1988.** Wilson, R.B. Jr.; Chan, Yee Wai; Posin, B.M. SRI International, Menlo Park, CA (United States). 20 May 1988. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014806. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop catalysts that directly convert methane and light hydrocarbons to intermediates that later can be converted to either liquid fuels or value-added chemicals, as economics dictate. During this reporting period, we synthesized several phthalocyanine catalysts supported on magnesia (MgO) in Task 3. In Task 4 we have tested these catalysts for oxidation of methane and did a number of blank experiments to determine the cause of the low methanol yield we have observed. Magnesia supported catalysts were prepared by first synthesizing the various metal tetrasulfophthalocyanines (TSPCs), converting them to the acid form, and then supporting these complexes on a basic support (MgO) by a neutralization reaction. The metals used were Ru, Pd, Cu, Fe, Co, Mn, and Mo. CoTSPC was also synthesized in zeolite Y using our standard template techniques described in Quarterly Report No. 1. These complexes were examined for catalytic activity in the oxidation of methane. The PdTSPC/MgO had greater activity, and oxidized some of the methane (selectivity of 2.8% from the methane oxidized at 375°C) to ethane. This is a much lower temperature for this reaction than previously reported in the literature. We also examined the reactivity of various components of the system in the oxidation of the product methanol. The reactor showed some activity for the oxidation of methanol to carbon dioxide. When zeolite or magnesia were added, this activity increased. The magnesia oxidized most of the methanol to carbon dioxide, while the zeolite reduced some of the methanol to hydrocarbons. With oxygen in the feed gas stream (i.e., the conditions of our methane oxidation), a very large fraction of the methanol was oxidized to carbon dioxide when passed over magnesia. From this, we can conclude that any methanol formed in the oxidation of methane would probably be destroyed very quickly on the catalyst bed.

23441 (DOE/PC/90011–T7) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 7, April 16, 1988–July 15, 1988.** Wilson, R.B. Jr.; Chan, Yee Wai; Posin, B.M. SRI International, Menlo Park, CA (United States). 31 Aug 1988. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014807. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop catalysts that directly convert methane and light hydrocarbons to intermediates that later can be converted to either liquid fuels or value-added chemicals, as economics dictate. During this reporting period, much of our effort focused on investigating the stability of the methane reforming catalysts (Task 2) with respect to storage time. Many of these catalysts demonstrated lessened activity when they were reexamined up to 18 months after they ere first synthesized and tested. We also synthesized and tested two new phthalocyanines supported on magnesia (MgO) for examination in the methane oxidation reaction. We reexamined many of the hexaruthenium and tetraruthenium clusters which had been supported on zeolite Y, zeolite 5A, alumina or magnesia. These reexaminations were conducted at relatively slow flow rates (15 ml/min), since previous studies had shown that the lower flow rates maximized the conversion of methane in this reaction. In every case, the catalyst exhibited diminished activity compared to the earlier runs. In addition, the selectivity of the catalysts changed as well; relatively less C_2 and no C_6 was observed in the reactions conducted during this reporting period. In the previous technical report we reported that palladium tetrasulfophthalocyanine (PDTSPC) supported on MgO exhibited exceptional activity in the methane oxidation reaction; it produced ethane at much lower temperatures than previously reported in the literature. We synthesized two close analogues of this compound, one with a different metal (nickel) from the same family as palladium, and the other with a different substituent (carboxylic acid rather than sulfonic acid) on the phthalocyanine ring. Both of these complexes were supported on magnesia, and tested for activity. The nickel complex displayed some activity, producing only carbon dioxide and water.

23442 (DOE/PC/90011–T8) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 8, July 16–September 30, 1988.** Wilson, R.B. Jr.; Posin, B.M.; Chan, Yee Wai. SRI International, Menlo Park, CA (United States). 1 Mar 1989. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014808. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop catalysts that directly convert methane and light hydrocarbons to intermediates that later can be converted to either liquid fuels or value-added chemicals, as economics dictate. During this reporting period, we investigated the behavior of some of our catalysts under working conditions using diffuse reflectance fourier transform infrared spectroscopy (DRIFT). Two catalysts ($FeRu_3$ and Ru_4 on magnesia) were examined under nitrogen, and the Ru_4/MgO system was examined under a methane/argon mixture. We synthesized ruthenium clusters supported on carbon as catalysts for methane reforming and new phthalocyanines to be used as catalyst precursors for oxidizing methane to methanol. The Ru_4 and $FeRu_3$ complexes supported on magnesia exhibited very different behavior in the DRIFT cell when heated under nitrogen. The $FeRu_3$/MgO system was completely decarbonylated by 400°C, while spectrum of the Ru_4 system displayed carbonyl peaks until the temperature rose to over 600°C. The ru_4/MgO system behaved almost identically under methane/argon as it did under nitrogen in the carbonyl region. In the C-H region of the spectrum (2800-3100 cm^{-1}), peaks were observed under methane but not under nitrogen. The intensity of these peaks did not vary with temperature. We synthesized new catalysts by supporting the Ru_4 and Ru_6 clusters on carbon. Both acidic zeolites (Type Y or 5A) and basic magnesia (MgO) have been observed to react with hydrocarbons at high temperatures; these reactions generally lead to coking, then deactivation of the catalyst contained on these supports. We expect carbon to be a truly inert support.

23443 (DOE/PC/90011–T9) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 9, October 1–December 31, 1988.** Wilson, R.B. Jr.; Posin, B.M.; Chan, Yee Wai. SRI International, Menlo Park, CA (United States). 10 Mar 1989. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014809. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop catalysts that directly convert methane and light hydrocarbons to intermediates that later can be converted to either liquid fuels or value-added chemicals, as economics dictate. During this reporting period, we completed our IR spectroscopic examination of the Ru_4/MgO and $FeRu_3$/MgO systems under nitrogen and methane by examining $FeRu_3$/MgO under methane. This system behaved quite differently than the same system under nitrogen. Under methane, only one very broad peak is observed at room temperature. Upon heating, the catalyst transformed so that by 300°C, the spectrum of $FeRu_3$/MgO under methane was the same as that of Ru_4/MgO. This suggests that methane promotes the segregation of the metals in the mixed metal system. The differences in catalytic activity between the $FeRu_3$/MgO and Ru_4/MgO systems may then be due to the presence of IR transparent species such as iron ions which cause different nucleation in the ruthenium clusters. We examined several systems for activity in the methane dehydrogenation reaction. Focusing on systems which produce C_6 hydrocarbons since this is the most useful product. These systems all displayed low activity so that the amount of hydrocarbon product is very low. Some C_6 hydrocarbon is observed over zeolite supports, but its production ceases after the first few hours of reaction. We prepared a new system, Ru_4 supported on carbon, and examined its reactivity. Its activity was very low and in fact the carbon support had the same level of activity. We synthesized four new systems for examination as catalysts in the partial oxidation of methane. Three of these (PtTSPC/MgO, PtTSPC and PdTSPC on carbon) are analogs of

PdTSPC/MgO. This system is of interest because we have observed the production of ethane from methane oxidation over PdTSPC/MgO at relatively low temperatures and we wished to explore its generality among close analogs.

23444 (DOE/PC/90011–T10) **Direct catalytic conversion of methane and light hydrocarbon gases. Quarterly report No. 10, January 1–March 31, 1989.** Wilson, R.B. Jr.; Posin, B.M.; Chan, Yee Wai. SRI International, Menlo Park, CA (United States). 19 May 1989. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90011. Order Number DE95014810. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop catalysts that directly convert methane and light hydrocarbons to intermediates that later can be converted to either liquid fuels or value-added chemicals, as economics dictate. In this reporting period, we have utilized samples of magnesia differing in their pretreatment temperature. Both the hydrido-ruthenium complex $H_4Ru_4(CO)_{12}$ and its reaction product with triethyl aluminum were reacted with these samples. The two ruthenium clusters are expected to react with the magnesia surface in different ways: by deprotonation of the hydride through an acid-base reaction with the basic surface, or by hydrolysis of the aluminum-carbon bond of the triethyl aluminum adduct. The concentration of hydroxyl groups on the magnesia surface able to hydrolyze the aluminum-carbon bond for immobilation should vary depending on the temperature of the pretreatment; the concentration of basic sites which can deprotonate the cluster should also vary with temperature. These differences were borne out by the experiment. We also compared the activity of two batches of $AlRu_4$/MgO which had been synthesized at different times in the project. Both batches had approximately the same activity, but the newer batch had greater selectivity for C_{6+} hydrocarbons.

23445 (LBL–37222) **Fundamental studies of the mechanism of catalytic reactions with catalysts effective in the gasification of carbon solids and the oxidative coupling of methane. Quarterly report, January 1, 1995–March 31, 1995.** Iglesia, E.; Perry, D.L.; Heinemann, H. Lawrence Berkeley Lab., CA (United States). Mar 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95015141. Source: OSTI; NTIS; GPO Dep.

The synthesis of ethane and ethylene from methane and oxygen will be carried out in novel hydrogen transport inorganic membranes and in cyclic reactors in order to prevent undesirable secondary reactions of C_2 molecules to CO and CO_2. Neither inorganic membrane reactors nor cyclic tubular reactors are presently used in commercial processes. Their application to catalytic reactions represents a novel application of engineering and solid-state chemistry concepts to catalytic reactions. Our approach combines high temperature membrane and cyclic experimental reactors, synthesis and characterization of thin membrane films and of high surface area catalysts, and detailed models of complex gas phase and surface reactions involved in oxidative coupling. We anticipate that this approach will lead to novel reactors for carrying our kinetic-controlled sequential reactions, such as the oxidative coupling of methane. Careful spectrographic and wet chemical analyses of fresh and silent catalysts have shown considerable differences which have permitted conclusions as to the source of deactivation. Our activities in the first quarter FYI 995 have focused on the synthesis, structural characterization, and catalytic evaluation of membrane films, disks, and reactors. We have also continued to exploit reaction-transport models to predict the performance of membrane, cyclic, and recycle reactors in the oxidative coupling of methane.

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Refer also to citation(s) 24571, 24626, 24627

23446 (ANL/EAD/TM–4) **Effects of Flaming Gorge Dam hydropower operations on flow and stage in the Green River, Utah and Colorado.** Yin, S.C.L. (Argonne National Lab., IL (United States). Environmental Assessment Div.); Cho, H.E.; McCoy, J.J.; Palmer, S.C. Argonne National Lab., IL (United States). May 1995. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95015177. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the development of Flaming Gorge Reservoir release patterns and resulting downstream flows and stages for four potential hydropower operational scenarios. The release patterns were developed for three representative hydrologic years: moderate, dry, and wet. Computer models were used to estimate flows and stages in the Green River resulting from these release patterns for the moderate water year. The four hydropower operational scenarios for Flaming Gorge Dam were year-round high fluctuating flows, seasonally adjusted high fluctuating flows, seasonally adjusted moderate fluctuating flows, and seasonally adjusted steady flows. The year-round high fluctuating flow scenario assumes that the monthly total reservoir releases would be the same as historical releases. The remaining seasonally adjusted flow scenarios would comply with the 1992 Biological Opinion of the US Fish and Wildlife Service, which requires high flows in the spring and limited hourly fluctuations, especially in summer and autumn releases, to protect endangered fish. Within one year, the maximum daily river stage fluctuations resulting from hydropower operations under the seasonally adjusted high fluctuating flow scenario would be similar to the maximum daily fluctuations under the year-round high fluctuating flow scenario. However, reduced or no fluctuations would occur in some time periods under the former scenario. The maximum daily river stage fluctuations under the seasonally adjusted moderate fluctuating flow scenario would be about half of those under the seasonally adjusted high fluctuating flow scenario.

23447 (ANL/EAD/TM–5) **Reservoir release patterns for hydropower operations at the Aspinall Unit on the Gunnison River, Colorado.** Yin, S.C.L. (Argonne National Lab., IL (United States). Environmental Assessment Div.); McCoy, J.J.; Sedlacek, J. Argonne National Lab., IL (United States). May 1995. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95016231. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the development of reservoir release patterns for the Aspinall Unit, which includes Blue Mesa, Morrow Point, and Crystal Reservoirs on the Gunnison River in Colorado. Release patterns were assessed for two hydropower operational scenarios–seasonally adjusted steady flows and seasonally adjusted high fluctuating flows–and three representative hydrologic years–moderate (1987), dry (1989), and wet (1983). The release patterns for the operational scenarios were developed with the aid of monthly, daily, and hourly reservoir operational models, which simulate the linked operation of the three Aspinall Unit reservoirs. Also presented are reservoir fluctuations and downstream water surface elevations corresponding to the reservoir release patterns. Both of the hydropower operational scenarios evaluated are based on the ecological research flows proposed by the US Fish and Wildlife Service for the Aspinall Unit. The first operational scenario allows only seasonally adjusted steady flows (no hourly fluctuations at any dam within one day), whereas the second scenario permits high fluctuating flows from Blue Mesa and Morrow Point Reservoirs during certain times of the year. Crystal Reservoir would release a steady flow within each day under both operational scenarios.

23448 (ANL/EAD/TM–6) **Effects of Flaming Gorge Dam hydropower operations on sediment transport in the Browns Park reach of the Green River, Utah and Colorado.** Williams, G.P. (Argonne National Lab., IL (United States). Environmental Assessment Div.); Tomasko, D.; Cho, H.E.; Yin, S.C.L. Argonne National Lab., IL (United States). May 1995. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95016232. Source: OSTI; NTIS; INIS; GPO Dep.

Three methods for comparing sediment transport were applied to four proposed hydropower operational scenarios under study for Flaming Gorge Dam on the Green River in Utah. These methods were effective discharge, equilibrium potential, and cumulative sediment load with flow exceedance plots. Sediment loads transported by the Green River in the Browns Park reach were calculated with

the Engelund-Hansen equation for three historical water years and four hydropower operational scenarios. A model based on the Engelund-Hansen equation was developed using site-specific information and validated by comparing predictions for a moderate water year with measured historical values. The three methods were used to assess the impacts of hydropower operational scenarios on sediment resources. The cumulative sediment load method provided the most useful information for impact evaluation. Effective discharge was not a useful tool because of the limited number of discrete flows associated with synthetic hydrographs for the hydropower operational scenarios. The equilibrium potential method was relatively insensitive to the variations in operating conditions, rendering it comparatively ineffective for impact evaluation.

23449 (ANL/EAD/TM–10) **Potential effects of four Flaming Gorge Dam hydropower operational scenarios on riparian vegetation of the Green River, Utah and Colorado.** LaGory, K.E. (Argonne National Lab., IL (United States). Ecological Sciences Section); Van Lonkhuyzen, R.A. Argonne National Lab., IL (United States). Jun 1995. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95016233. Source: OSTI; NTIS; INIS; GPO Dep.

Four hydropower operational scenarios at Flaming Gorge Dam were evaluated to determine their potential effects on riparian vegetation along the Green River in Utah and Colorado. Data collected in June 1992 indicated that elevation above the river had the largest influence on plant distribution. A lower riparian zone occupied the area between the approximate elevations of 800 and 4,200-cfs flows–the area within the range of hydropower operational releases. The lower zone was dominated by wetland plants such as cattail, common spikerush, coyote willow, juncus, and carex. An upper riparian zone was above the elevation of historical maximum power plant releases from the dam (4,200 cfs), and it generally supported plants adapted to mesic, nonwetland conditions. Common species in the upper zone included box elder, rabbitbrush, grasses, golden aster, and scouring rush. Multispectral aerial videography of the Green River was collected in May and June 1992 to determine the relationship between flow and the areas of water and the riparian zone. From these relationships, it was estimated that the upper zone would decrease in extent by about 5% with year-round high fluctuation, seasonally adjusted high fluctuation, and seasonally adjusted moderate fluctuation, but it would increase by about 8% under seasonally adjusted steady flow. The lower zone would increase by about 13% for both year-round and seasonally adjusted high fluctuation scenarios but would decrease by about 40% and 74% for seasonally adjusted moderate fluctuation and steady flows, respectively. These changes are considered to be relatively minor and would leave pre-dam riparian vegetation unaffected. Occasional high releases above power plant capacity would be needed for long-term maintenance of this relict vegetation.

23450 (DOE/BP/00276–2) **Yakima River radio-telemetry study: Steelhead, 1989–93.** Hockersmith, E.; Vella, J.; Stuehrenberg, L.; Iwamoto, R.N.; Swan, G. National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div. Jan 1995. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-89BP00276. Order Number DE95014444. Source: OSTI; NTIS; GPO Dep.

A 4-year radio-telemetry study was made of steelhead in the Yakima River basin, with the objectives of determining the run timing, passage patterns at irrigation diversion dams, and morphometric characteristics of different Yakima basin steelhead substocks and determining where and when the substocks become separated; evaluating adult steelhead passage at Yakima River basin diversion dams; determining steelhead migration , temporal distribution, and habitat utilization in the Yakima River basin; identifying spawning distribution and timing of steelhead; and determining the amount and cause of pre-spawning mortality of radio-tagged steelhead. Recommendations are given.

23451 (DOE/BP/01385–5) **Evaluation of juvenile fish bypass and adult fish passage facilities at water diversions on the Umatilla River. Annual report, 1994.** Knapp, S.M. Oregon Dept. of Fish and Wildlife, Portland, OR (United States). Jan 1995. 143p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-89BP01385. Order Number DE95014446. Source: OSTI; NTIS; GPO Dep.

We report on our progress from October 1993 through September 1994 in evaluating juvenile salmonid bypass facilities and juvenile salmonid passage through ladder facilities, and investigating passage conditions for juvenile fish at diversion dam facilities on the lower Umatilla River in northeastern Oregon. We also report on our progress in evaluating adult salmonid passage at and between dams on the lower Umatilla River and upriver migration using radio telemetry. Two principal studies are also included. Report A (ODFW): To evaluate the juvenile salmonid bypass facilities a Feed and Furnish canals, juvenile salmonid passage through fish ladders at Stanfield, Feed Canal, Westland, and Three Mile Falls dams, and the juvenile salmonid trap and haul procedures at Westland Canal. To investigate passage conditions at all passage facilities. Report B (CTUIR): To examine the passage of adult salmonids past diversions in the lower Umatilla River and their movement in the upper river after transport, using radio telemetry, and to assess factors for successful homing. These studies are part of a program to rehabilitate anadromous fish stocks in the Umatilla River Basin, including restoration of coho salmon (Oncorhynchus kisutch) and chinook salmon (Oncorhynchus tshawytscha), as well as enhancement of summer steelhead (Oncorhynchus mykiss).

23452 (DOE/BP–2589) **Yakima Fisheries Project revised Draft Environmental Impact Statement: Summary.** USDOE Bonneville Power Administration, Portland, OR (United States). May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). (DOE/EIS–0169). Order Number DE95014756. Source: OSTI; NTIS; INIS; GPO Dep.

The Bonneville Power Administration (BPA) proposes to fund the Yakima Fisheries Project (YFP) to undertake fishery research and enhancement activities in the Yakima River Basin. The State of Washington and the Yakima Indian Nation would jointly direct the project. The Yakima River system is a promising location for mitigation and enhancement to compensate for stock losses from development and operation of hydroelectric projects elsewhere in the Columbia Basin. The YFP would help determine the role that supplementation might play in increasing natural production of anadromous salmonids throughout the Columbia Basin. In cooperation with BPA, the project managers propose to construct, operate and maintain anadromous (e.g. salmon) fish production facilities. The goal is to conduct research activities designed to increase knowledge of supplementation techniques. These techniques would be applied to rebuild naturally spawning anadromous fish stocks historically present in the Yakima River Basin and, ultimately, those throughout the Columbia River Basin. Eventually, the YFP might involve the supplementation of all stocks of anadromous fish known to have occurred in the Yakima Basin. However, at this time only two alternatives have been proposed: Alternative 1 would supplement depressed naturally spawning populations of upper Yakima spring chinook salmon; Alternative 2 (preferred) would include all actions under Alternative 1; it would also add a study to determine the feasibility of re-establishing a naturally spawning population and a significant fall fishery for coho salmon in the Yakima Basin. (Coho smolts are currently being imported from another basin under the Columbia River Basin Fish Management Plan; the stock is now virtually eliminated from the Basin.)

23453 (DOE/BP/10891–2) **Survival estimates for the passage of juvenile salmonids through Snake River dams and reservoirs, 1994.** Muir, W.D. (and others); Smith, S.G.; Iwamoto, R.N. National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div. Feb 1995. 210p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-93BP10891. Order Number DE95014363. Source: OSTI; NTIS; GPO Dep.

In 1994, the National Marine Fisheries Service and the University of Washington completed the second year of a multi-year study to estimate survival of juvenile salmonids (Oncorhynchus spp.) passing through the dams and reservoirs of the Snake River. Actively migrating smolts were collected at selected locations above, at, and below Lower Granite Dam, tagged with passive integrated transponder (PIT) tags, and released to continue their downstream

migration. Survival estimates were calculated using the Single-Release, Modified Single-Release, and Paired-Release Models.

23454 (DOE/BP/11631–10) **Smolt monitoring at the Head of Lower Granite Reservoir and Lower Granite Dam. Annual report for 1993 Operations.** Buettner, E.W.; Brimmer, A.F. Idaho Dept. of Fish and Game, Boise, ID (United States). Mar 1995. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-83BP11631. Order Number DE95014411. Source: OSTI; NTIS; GPO Dep.

This project monitored the daily passage of chinook salmon Oncorhynchus tshawytscha and steelhead trout O. mykiss smolts during the 1993 spring outmigration at migrant traps on the Snake River, Clearwater River and Salmon River.

23455 (DOE/BP/11982–5) **A study to determine the biological feasibility of a new fish tagging system, 1990–1993.** Prentice, E.F. (and others); Maynard, D.J.; Downing, S.L. National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div. 1994. 250p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-84BP11982. Order Number DE95014448. Source: OSTI; NTIS; GPO Dep.

In 1983, the National Marine Fisheries Service (NMFS) began a multiyear cooperative research program with the Bonneville Power Administration (BPA) to evaluate a new miniaturized identification system that could be used with salmonids. The system is referred to as the passive-integrated-transponder (PIT) tagging and interrogation system. The program has focused on determining the effects of PIT tags on juvenile and adult salmonids, as well as the development and evaluation of tagging and interrogation methods. Earlier results of the program have been reported in annual reports and journal articles cited in this report. This report covers the work per formed from 1990 through 1993. For convenience, the report is divided into three sections: (1) Interrogation and separation systems at Columbia River Basin dams; (2) Systems development and evaluation; and (3) Information and technology transfer.

23456 (DOE/BP/21182–5) **Intensive evaluation and monitoring of chinook salmon and steelhead trout production, Crooked River and Upper Salmon River sites. Annual progress report, January 1, 1992–December 31, 1992.** Kiefer, R.B.; Lockhart, J.N. Idaho Dept. of Fish and Game, Boise, ID (United States). Fisheries Research Section. Dec 1994. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-91BP21182. Order Number DE95014408. Source: OSTI; NTIS; GPO Dep.

The purpose of this intensive monitoring project is to determine the number of returning chinook salmon Oncorhynchus tshawytscha and steelhead trout 0. mykiss adults necessary to achieve optimal smolt production, and develop mitigation accounting based on increases in smolt production. Two locations in Idaho are being intensively studied to meet these objectives. Information from this research will be applied to parr monitoring streams statewide to develop escapement objectives and determine success of habitat enhancement projects.

23457 (DOE/BP/25105–2) **Analysis of chinook salmon in the Columbia River from and ecosystem perspective. Final report.** Lichatowich, J.A.; Mobrand, L.E. Mobrand Biometrics, Inc., Vashon Island, WA (United States). Jan 1995. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AM79-92BP25105. Order Number DE95014417. Source: OSTI; NTIS; GPO Dep.

Ecosystem Diagnosis and Treatment (EDT) methodology was applied to the analysis of chinook salmon in the mid-Columbia subbasins which flow through the steppe and steppe-shrub vegetation zones. The EDT examines historical changes in life history diversity related to changes in habitat. The emphasis on life history, habitat and historical context is consistent with and ecosystem perspective. This study is based on the working hypothesis that the decline in chinook salmon was at least in part due to a loss of biodiversity defined as the intrapopulation life history diversity. The mid Columbia subbasins included in the study are the Deschutes, John Day, Umatilla, Tucannon and Yakima.

23458 (DOE/BP/35768–4) **Umatilla River Basin Anadromous Fish Habitat Enhancement Project. annual report 1991.** Scheeler, C.A. Confederated Tribes of the Umatilla Indian Reservation, Pendleton, OR (United States). Dept. of Natural Resources. Jan 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-87BP35768. Order Number DE95013842. Source: OSTI; NTIS; GPO Dep.

The Umatilla habitat improvement program targets the improvement of water quality and restoration of riparian areas, holding, spawning,and rearing habitats of steelhead, spring and fall Chinook and coho salmon. This report covers work accomplished by the Confederated Tribes of the Umatilla Indian Reservation from April 1991 through May 1992. This program is funded under the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program (Measure 704 (d)(1) 34.02) as partial mitigation for construction of hydroelectric dams and the subsequent losses of anadromous fish throughout the Columbia River system.

23459 (DOE/BP/35768–5) **Umatilla River Basin Anadromous Fish Habitat Enhancement Project. 1992 annual report.** Scheeler, C.A.; Shaw, R.T. Confederated Tribes of the Umatilla Indian Reservation, Pendleton, OR (United States). Dept. of Natural Resources. Jan 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-87BP35768. Order Number DE95014410. Source: OSTI; NTIS; GPO Dep.

The Umatilla habitat improvement program targets improvement of water quality and the restoration of riparian areas, holding, spawning and rearing habitats of steelhead, spring and fall Chinook and coho salmon. The Confederated Tribes of the Umatilla Indian Reservation are responsible for enhancing stream reaches within the Reservation boundaries as guided by an implementation plan developed cooperatively with the Oregon Department of Fish and Wildlife and the U.S.D.A. Forest Service, Umatilla National Forest. Enhancements included the construction of nine boulder deflectors, two boulder weirs with pools, and 4 instream boulder placements. Instream cover was improved through the placement of 38 instream cover trees that were cabled to anchor boulders and four rootwads placed and anchored in pools. High tensile fence was constructed along 1.2 miles of stream bank to exclude livestock from riparian areas.

23460 (DOE/BP/41841–2) **Redfish Lake sockeye salmon captive broodstock rearing and research. Annual report 1993.** Flagg, T.A. (National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.); McAuley, W.C. National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.; USDOE Bonneville Power Administration, Portland, OR (United States). Div. of Fish and Wildlife. Nov 1994. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-92BP41841. Order Number DE95014415. Source: OSTI; NTIS; GPO Dep.

The National Marine Fisheries Service (NMFS), in cooperation with Idaho and BPA, has established captive broodstocks to aid recovery of endangered Snake River sockeye salmon. NMFS is currently maintaining four separate Redfish Lake sockeye Salmon captive broodstocks; all these broodstocks are being reared full-term to maturity in fresh (well) water. Experiments are also being conducted on nonendangered 1990 and 1991-brood Lake Wenatchee (WA) sockeye salmon to compare effects on survival and reproduction to maturity in fresh water and seawater; for both brood-years, fish reared in fresh water were larger than those reared in seawater. Data from captive rearing experiments suggest a ranking priority of circular tanks supplied with pathogen-free fresh water, circular tanks supplied with pumped/filtered/uv-sterilized seawater, and seawater net-pens for rearing sockeye salmon to maturity.

23461 (DOE/BP/91819–10) **Artificial imprinting and smoltification in juvenile kokanee salmon: Implications for operating Lake Roosevelt kokanee salmon hatcheries. Annual report 1994.** Tilson, M.B.; Scholz, A.T.; White, R.J.; Hendrickson, J.L. Eastern Washington Univ., Cheney, WA (United States). Upper Columbia United Tribes Fisheries Research Center. Feb 1995. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-88BP91819. Order Number DE95014445. Source: OSTI; NTIS; GPO Dep.

At the kokanee salmon hatcheries on Lake Roosevelt, constructed as partial mitigation for effects from Grand Coulee Dam, adult returns have been poor. The reason may be in the imprinting or in the smoltification. A study was initiated in 1992 to determine if there was a critical period for thyroxine induced olfactory imprinting in kokanee salmon; experiments were conducted on imprinting to morpholine and phenethyl alcohol. Other results showed that chemical imprinting coincided with elevated thyroxine levels in 1991 kokanee exposed to synthetic chemicals in 1992. In this resport, imprinting experiments were repeated; results showed that imprinting occurred concomitant with elevated thyroxine levels in 1991 kokanee exposed to synthetic chemicals in 1992 and tested in 1994 as age 3 spawners. Imprinting also occurred at the same time as thyroxine peaks in 1992 kokanee exposed to synthetic chemicals in 1993 and tested as age 2 spawners. In both groups fish that had the highest whole body thyroxine content (swimup stage) also had the highest percentage of fish that were attracted to their exposure odor in behavioral tests. So, kokanee salmon imprinted to chemical cues during two sensitive periods during development, at the alevin/swimup and smolt stages. A field test was conducted in Lake Roosevelt on coded wire tagged fish. Smoltification experimentswere conducted from 1992 to 1994. Recommendations are made for the Lake Roosevelt kokanee hatcheries.

23462 (DOE/BP/93743–1) **Kootenai River white sturgeon studies.** Anders, P.J. Kootenai Tribe of Idaho, Bonners Ferry, ID (United States). Dec 1993. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-88BP93743. Order Number DE95014443. Source: OSTI; NTIS; GPO Dep.

This report evaluates natural spawning of white sturgeon in the Kootenai River before, during and after the 1993 augmented discharge period. To determine how altering the operation of Libby Dam may improve conditions for natural spawning of white sturgeon in the Kootenai River, discharge from Libby Dam (with no power peaking or load following) was increased to produce 20 kcfs (± 2 kcfs) discharge at Bonners Ferry, Idaho, for a 14 day period June 2–16. Objectives of this research were to determine if white sturgeon spawned in the Kootenai River during 1993; and collect baseline biological data including timing, location, and habitat requirements of white sturgeon spawning in the Kootenai River in order to formulate and implement future flow regimes as effective recovery measures for white sturgeon. While sampling is not expected to collect a majority of white sturgeon eggs or larvae produced in a river, the fact that over 41,000 hours of sampling (combined gear) collected only 3 white sturgeon eggs and no larvae suggests that spawning conditions during 1993 were inadequate to benefit this population.

23463 (DOE/EA–1040) **Lower Columbia river terminal fisheries research project. Final environmental assessment.** Bonneville Power Administration, Portland, OR (United States). Apr 1995. 67p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014998. Source: OSTI; NTIS; GPO Dep.

This notice announces BPA'S's decision to fund the Oregon Department of Fish and Wildlife (ODFW), the Washington Department of Fish and Wildlife (WDFW), and the Clatsop Economic Development Committee for the Lower Columbia River Terminal Fisheries Research Project (Project). The Project will continue the testing of various species/stocks, rearing regimes, and harvest options for terminal fisheries, as a means to increase lower river sport and commercial harvest of hatchery fish, while providing both greater protection of weaker wild stocks and increasing the return of upriver salmon runs to potential Zone 6 Treaty fisheries. The Project involves relocating hatchery smolts to new, additional pen locations in three bays/sloughs in the lower Columbia River along both the Oregon and Washington sides. The sites are Blind Slough and Tongue Point in Clatsop County, Oregon, and Grays Bay/Deep River, Wahkiakum County, Washington. The smolts will be acclimated for various lengths of time in the net pens and released from these sites. The Project will expand upon an existing terminal fisheries project in Youngs Bay, Oregon. The Project may be expanded to other sites in the future, depending on the results of this initial expansion. BPA'S has determined the project is not a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an environmental impact statement is not required, and BPA'S is issuing this FONSI.

23464 (DOE/EIS–0169) **Yakima fisheries project. Revised draft environmental impact statement.** USDOE Bonneville Power Administration, Portland, OR (United States). May 1995. 391p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014364. Source: OSTI; NTIS; INIS; GPO Dep.

BPA proposes to fund several fishery-related activities in the Yakima River Basin. These activities, known as the Yakima Fisheries Project (YFP), would be jointly managed by the State of Washington and the Yakima Indian Nation. The YFP is included in the Northwest Power Planning Council's (Council's) fish and wildlife program. The Council selected the Yakima River system for attention because fisheries resources are severely reduced from historical levels and because there is a significant potential for enhancement of these resources. BPA's proposed action is to fund (1) information gathering on the implementation of supplementation techniques and on feasibility of reintroducing coho salmon in an environment where native populations have become extinct; (2) research activities based on continuous assessment, feedback and improvement of research design and activities (adaptive management); and (3) the construction, operation, and maintenance of facilities for supplementing populations of upper Yakima spring chinook salmon. Major issues examined in the Revised Draft EIS include potential impacts of the project on genetic and ecological resources of existing fish populations, on water quality and quantity, on threatened and endangered species listed under the Endangered Species Act, and on the recreational fishery. Only minor differences in environmental consequences were found between Alternatives 1 and 2. Potentially high impacts on wild, native, and non-target fish populations under both alternatives would be mitigated through careful adherence to the adaptive management process outlined in the EIS.

23465 (DOE/EIS–0169-Rev.) **Yakima Fisheries Project: Revised draft environmental impact statement.** USDOE Bonneville Power Administration, Portland, OR (United States). May 1995. 391p. Sponsored by USDOE, Washington, DC (United States). (DOE/BP–2588). Order Number DE95015000. Source: OSTI; NTIS; GPO Dep.

BPA proposes to fund several fishery-related activities in the Yakima River Basin. The Yakima Fisheries Project (YFP), included in the Northwest Power Planning Council's fish and wildlife program, would be jointly managed by the State of Washington and the Yakima Indian Nation. Fisheries resources in the Yakima River are severely reduced from historical levels and there is a significant potential for enhancement of these resources. BPA's proposed action is to fund (1) information gathering on the implementation of supplementation techniques and on feasibility of reintroducing coho salmon in an environment where native populations have become extinct; (2) research activities based on continuous assessment, feedback and improvement of research design and activities ("adaptive management"); and (3) the construction, operation, and maintenance of facilities for supplementing populations of upper Yakima spring chinook salmon. The project has been considerably revised from the original proposal described in the first draft EIS. Examined in addition to No Action (which would leave present anadromous fisheries resources unchanged in the, Basin) are two alternatives for action: (1) supplementation of depressed natural populations of upper Yakima spring chinook and (2) that same supplementation plus a study to determine the feasibility of re-establishing (via stock imported from another basin) naturally spawning population and a significant fall fishery for coho in the Yakima Basin. Alternative 2 has been identified as the preferred action. Major issues examined in the Revised Draft EIS include potential impacts of the project on genetic and ecological resources of existing fish populations, on water quality and quantity, on threatened and endangered species listed under the Endangered Species Act, and on the recreational fishery.

14 SOLAR ENERGY

1405 Solar Energy Conversion

23466 (CONF-940423–2) **Numerical modeling of the temperature illumination intensity dependent performance of CIS solar cells.** Lee, Y.J. (Purdue Univ., Lafayette, IN (United States). School of Electrical Engineering); Gray, J.L. National Renewable Energy Lab., Golden, CO (United States); Purdue Univ., Lafayette, IN (United States). School of Electrical Engineering. [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. From 12. European photovoltaic solar energy conference and exhibition; Amsterdam (Netherlands); 11-15 Apr 1994. Order Number DE95016104. Source: OSTI; NTIS; GPO Dep.

In this paper, the temperature dependence of CIS solar cell illuminated I-V is studied numerically using ADEPT. The effects of having a second junction either at the interface or at the back contact are investigated. These two placements of the second junction result in two distinctive shapes of the I-V at low temperatures. Both of these distinctive shapes have been observed experimentally.

23467 (CONF-941203–28) **Numericl modeling of graded band gap CIGS solar cells.** Gray, J.L.; Lee, Youn Jung. Purdue Univ., Lafayette, IN (United States). School of Electrical Engineering. [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. From 1. world conference on photovoltaic energy conversion; Waikoloa, HI (United States); 5-9 Dec 1994. Order Number DE95016102. Source: OSTI; NTIS; GPO Dep.

The high efficiency reported recently by NREL for CIGS solar cells demonstrates the potential of band gap grading in producing high efficiency thin film solar cells. In order to reap the full benefits of this design strategy, a clear understanding of the fundamental device physics of these structures is needed. The purpose of this paper is to examine the role grading of the band gap plays in achieving high conversion efficiencies. To aid in this examination, a detailed numerical device simulation program, ADEPT, is used.

23468 (DOE/ER/13969–3) **The Center for the Study of Early Events in Photosynthesis. Final report, September 1, 1988–August 31, 1994.** Orr, L.A. Arizona State Univ., Tempe, AZ (United States). [1994]. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER13969. Order Number DE95013801. Source: OSTI; NTIS; GPO Dep.

The ASU Center for the Study of Early Events in Photosynthesis was established in 1988 with funding through a five-year grant from the USDA/DOE/NSF Plant Science Center program and a grant from the NSF Biological Facilities program. Its scientific objective is to elucidate the basic principles that govern photosynthetic energy collection and storage. Understanding these principles is vital to mankind, as photosynthesis provides most of our food, fiber and energy needs. The Center attempts to fulfill this objective through research of the highest standard, coupled inextricably with quality education at the undergraduate, graduate and postdoctoral levels. These goals are met via a network of collaborative, interdisciplinary research groups comprising 100 personnel within the Department of Chemistry and Biochemistry, the Department of Botany, and the Department of Physics and Astronomy. The work of these research groups is facilitated by the Center through a variety of important infrastructural functions.

23469 (ETDE-BR–0007) **Techniques for the obtention of thin junctions aiming the fabrication of solar cells for space application.** Beloto, A.F. (Instituto de Pesquisas Espaciais, Sao Paulo, SP (Brazil)); Pereyra, I. No corporate text available. [1995]. 3p. (In Portugese). Order Number DE95789951. Source: OSTI; NTIS (US Sales Only).

Two annealing techniques used for solar cells fabrication were compared in order to determine the annealing effects on cells and to verify their performance. An experimental study aiming the development of ion implantation silicon solar cells for space use is studied. 5 refs, 2 figs, 2 tabs

23470 (ETDE-BR–0011) **Study of the characteristics of single crystal silicon solar cells.** Beloto, Antonio Fernando. Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica. 1983. 146p. (In Portugese). Order Number DE95789955. Source: OSTI; NTIS (US Sales Only).

Systems of measurement were developed for the characterization of single crystal silicon solar cells. For that, the curves I x V were measured in the dark and for different intensity of illumination. Curves of spectral response and of capacitance as a function of the reciprocal of the voltage were also measured. The behavior of the cells as a function of temperature was analysed and also measurements of junction depth were made by three different methods. values for the parameters that characterize the cells were obtained, showing a good agreement with theoretical values and also with already reported values. (author). 30 refs, 63 figs, 10 tabs

23471 (ETDE/CH-mf–95795488) **Paul Scherrer Institut annual report 1994. Annex III B: PSI applied solid state physics.** Kuse, D. (ed.). Paul Scherrer Inst. (PSI), Villigen (Switzerland). Dept. F3B Applied Solid State Physics. [1995]. 82p. Order Number DE95795488. Source: OSTI; NTIS.

The document reports on PSI Department IIIB's progress achieved during 1994 in the fields of nanotechnology, photovoltaics, semiconductor quantum structures, III-V heterostructure devices, micro- and integrated optics, optical metrology. Facilities for micro- and nanotechnology at PSI Villigen are described. A bibliography of the department's publication is included. figs., tabs., refs.

23472 (NREL/SP–463-7668) **User's manual for TMY2s: Derived from the 1961–1990 National Solar Radiation Data Base.** Marion, W.; Urban, K. National Renewable Energy Lab., Golden, CO (United States). Jun 1995. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95004064. Source: OSTI; NTIS; GPO Dep.

This report is a user's manual that describes typical meteorological year (TMY) data sets derived from the 1961-1990 National Solar Radiation Data Base. The TMY is a data set of hourly values of solar radiation and meteorological elements for a 1-year period. The intended use if for computer simulations of solar energy conversion systems and building systems. Section 1 of the manual provides general information about the TMYs; Section 2 lists the stations and provides station identifying information and classification; Section 3 details the contents of the TMY2 files and provides the hourly records of data values; Section 4 compares TMY2 with 30-year data sets; Appendices provide procedures used to develop TMYs and a table to convert SI data to other units.

23473 (NREL/TP–410-7993) **NREL Photovoltaic Program. FY 1994 annual report, October 1, 1993–September 30, 1994.** National Renewable Energy Lab., Golden, CO (United States). Jun 1995. 427p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009244. Source: OSTI; NTIS; GPO Dep.

This report summarizes the in-house and subcontracted research and development activities under the National renewable Energy Laboratory (NREL) Photovoltaics (PV) program for fiscal year 1994. Research is organized under the following areas; PV program management; crystalline silicon and advanced devices; thin-film PV technologies; PV manufacturing; PV module and system performance and engineering; and PV applications and markets.

23474 (NREL/TP–411-8005) **Development of a photovoltaic module energy ratings methodology.** Kroposki, B. (National Renewable Energy Lab., Golden, CO (United States)); Mrig, L.; Whitaker, C.; Newmiller, J. National Renewable Energy Lab., Golden, CO (United States). May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. (CONF-950585–1: 13. NREL photovoltaics program review meeting, Lakewood, CO (United States), 16-19 May 1995). Order Number DE95009221. Source: OSTI; NTIS; GPO Dep.

The National Renewable Energy Laboratory has begun work on developing a consensus-based approach to rating photovoltaic modules. This new approach was intended to address the limitations of the defacto standard module power rating at standard test conditions. Using technical input from a number of sources, and under the guidance of an industry-based technical review committee, the approach described in this paper was developed. The Module

Energy Rating (MER) consists of 10 estimates of how much energy a single typical module of a particular type will produce in one day, one for each of 5 different weather/location combinations and 2 load-types. This paper presents an overview of the procedures required to generate an MER for any particular module type.

23475 (NREL/TP–411-8019) **The future of amorphous silicon photovoltaic technology.** Crandall, R.; Luft, W. National Renewable Energy Lab., Golden, CO (United States). Jun 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009235. Source: OSTI; NTIS; GPO Dep.

Amorphous silicon modules are commercially available. They are the first truly commercial thin-film photovoltaic (PV) devices. Well-defined production processes over very large areas (>1 m^2) have been implemented. There are few environmental issues during manufacturing, deployment in the field, or with the eventual disposal of the modules. Manufacturing safety issues are well characterized and controllable. The highest measured initial efficiency to date is 13.7% for a small triple-stacked cell and the highest stabilized module efficiency is 10%. There is a consensus among researchers, that in order to achieve a 15% stabilized efficiency, a triple-junction amorphous silicon structure is required. Fundamental improvements in alloys are needed for higher efficiencies. This is being pursued through the DOE/NREL Thin-Film Partnership Program. Cost reductions through improved manufacturing processes are being pursued under the National Renewable Energy Laboratory/US Department of Energy (NREL/DOE)-sponsored research in manufacturing technology (PVMaT). Much of the work in designing a-Si devices is a result of trying to compensate for the Staebler-Wronski effect. Some new deposition techniques hold promise because they have produced materials with lower stabilized defect densities. However, none has yet produced a high efficiency device and shown it to be more stable than those from standard glow discharge deposited material.

23476 (NREL/TP–413-8121) **Research on high-efficiency, large-area $CuInSe_2$-based thin-film modules. Final subcontract report, 16 August 1993–30 June 1995.** Tarrant, D.E. (Siemens Solar Industries, Camarillo, CA (United States)); Gay, R.R. National Renewable Energy Lab., Golden, CO (United States); Siemens Solar Industries, Camarillo, CA (United States). Jul 1995. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009257. Source: OSTI; NTIS; GPO Dep.

This final subcontract report, describing work to fabricate a large-area, stable, 12.5% (aperture)-efficient encapsulated $CuInSe_2$ (CIS) module by scalable, low-cost techniques on inexpensive substrates. Demonstrated encapsulated module efficiencies (encapsulated 12.8%-efficient mini-module on 68.9cm^2 and an NREL-verified 12.7%-efficient unencapsulated circuit on 69 CM^2 with a prismatic cover) are the highest reported mini-module demonstrated (and verified by NREL). This is the first thin-film module of its size to exceed the 10% efficiency level. SSI also supplied NREL with a 1-kW array of large-area (~3890 CM^2) approximately 30-W modules. The NREL-verified performance of this array is a significant step toward meeting the efficiency target of the USDOE Five-Year Plan goals of 8%–10%-efficient commercial thin-film, flat-plate modules. Long-term outdoor stability of CIS and CIS-based absorbers was demonstrated by testing at NREL. Excellent stability was demonstrated for 6 years of outdoor exposure. The stability of the 1-kW Siemens CIS array, installed and tested at NREL, was also demonstrated for an exposure of about 1 year. The foundations have been laid to meet the thin-film milestones of the DOE Five-Year Plan. Outdoor testing has demonstrated excellent intrinsic module stability. Future plans include scaling these results to larger areas and emphasizing the reduction of variation methodology to lay the foundation for demonstrating the potential of CIS as a future commercial product.

23477 (NREL/TP–451-8101) **Research on the stability, electronic properties, and structure of a-Si:H and its alloys. Final subcontract report, 1 June 1991–31 May 1994.** Jackson, W.B. (Xerox Palo Alto Research Center, CA (United States)); Johnson, N.; Nickel, N.; Schumm, G.; Street, R.A.; Thompson, R.; Tsai, C.C.; Van de Walle, C.; Walker, J. National Renewable Energy Lab., Golden, CO (United States); Xerox Palo Alto Research Center, CA (United States). Jul 1995. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009238. Source: OSTI; NTIS; GPO Dep.

The authors research has focused on defect metastability and a-Si:C:H alloys. A new aspect of the metastability is the growing interest in the defect recovery process. They have continued to explore the role of hydrogen in the metastability and other properties of a-Si:H. This has led them to perform first principles calculations of Si-H bonding configurations. Another new feature of the metastability work is the study of the effects in hydrogenated polysilicon. They have grown and studied the properties of a-Si:C:H alloys, particularly to observe the effects of hydrogen dilution. Finally they have also studied the recent defect relaxation phenomenon, and concluded that the effects arise from contact effects and are not an intrinsic effect in a-Si:H. Section A presents some recent models of metastability. Section B discusses the metastability and equilibration effects in hydrogenated polysilicon, studied because of it's close similarity to a-Si:H. Section C describes results on a-Si:C:H alloys. Section D contains first principle LDA calculations of Si-H bonds and relates these results to the a-Si:H diffusion and metastability properties. In section E the authors report capacitance measurements aimed at exploring the recent results by Cohen et al who find an anomalous relaxation process from the trap filling kinetics of a DLTS experiment.

23478 (NREL/TP–451-8117) **Numerical modeling of $CuInSe_2$ and CdTe solar cells. Annual subcontract report, March 1, 1994–February 28, 1995.** Gray, J.L. (Purdue Univ., West Lafayette, IN (United States)); Schwartz, R.J.; Lee, Y.J. National Renewable Energy Lab., Golden, CO (United States). Jul 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009263. Source: OSTI; NTIS; GPO Dep.

This report describes a mathematical model for application to copper selenide solar cells, indium selenide solar cells, and cadmium telluride solar cells.

23479 (UCRL-JC–118267) **A solar module fabrication process for HALE solar electric UAVs.** Carey, P.G. (Lawrence Livermore National Lab., CA (United States)); Aceves, R.C.; Colella, N.J.; Williams, K.A.; Sinton, R.A.; Glenn, G.S. Lawrence Livermore National Lab., CA (United States). 12 Dec 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941203–25: 1. world conference on photovoltaic energy conversion, Waikoloa, HI (United States), 5-9 Dec 1994). Order Number DE95011719. Source: OSTI; NTIS; GPO Dep.

We describe a fabrication process used to manufacture high power-to-weight-ratio flexible solar array modules for use on high-altitude-long-endurance (HALE) solar-electric unmanned air vehicles (UAVs). These modules have achieved power-to-weight ratios of 315 and 396 W/kg for 150μm-thick monofacial and 110μm-thick bifacial silicon solar cells, respectively. These calculations reflect average module efficiencies of 15.3% (150μm) and 14.7% (110μm) obtained from electrical tests performed by Spectrolab, Inc. under AMO global conditions at 25°C, and include weight contributions from all module components (solar cells, lamination material, bypass diodes, interconnect wires, and adhesive tape used to attach the modules to the wing). The fabrication, testing, and performance of 32 m^2 of these modules will be described.

1406 Photovoltaic Power Systems

Refer also to citation(s) 23473, 23654

23480 (DOE/AL/82993–13) **Davis PV plant operation and maintenance manual.** Pacific Gas and Electric Co., San Ramon, CA (United States). Dept. of Research and Development. Sep 1994. 214p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-92AL82993. Order Number DE95013807. Source: OSTI; NTIS; GPO Dep.

This operation and maintenance manual contains the information necessary to run the Photovoltaics for Utility Scale Applications

(PVUSA) test facility in Davis, California. References to more specific information available in drawings, data sheets, files, or vendor manuals are included. The PVUSA is a national cooperative research and demonstration program formed in 1987 to assess the potential of utility scale photovoltaic systems.

23481 (DOE/AL/82993–19) **Photovoltaic balance-of-system designs and costs at PVUSA.** Reyes, A.B.; Jennings, C. Pacific Gas and Electric Co., San Ramon, CA (United States). Dept. of Research and Development. May 1995. 195p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-92AL82993. Order Number DE95014980. Source: OSTI; NTIS; GPO Dep.

This report is one in a series of 1994-1995 PVUSA reports that document PVUSA lessons learned at demonstration sites in California and Texas. During the last 7 years (1988 to 1994), 16 PV systems ranging from 20 kW to 500 kW have been installed. Six 20-kW emerging module technology (EMT) arrays and three turnkey (i.e., vendor designed and integrated) utility-scale systems were procured and installed at PVUSA's main test site in Davis, California. PVUSA host utilities have installed a total of seven EMT arrays and utility-scale systems in their service areas. Additional systems at Davis and host utility sites are planned. One of PVUSA's key objectives is to evaluate the performance, reliability, and cost of PV balance-of-system (BOS). In the procurement stage PVUSA encouraged innovative design to improve upon present practice by reducing maintenance, improving reliability, or lowering manufacturing or construction costs. The project team worked closely with suppliers during the design stage not only to ensure designs met functional and safety specifications, but to provide suggestions for improvement. This report, intended for the photovoltaic (PV) industry and for utility project managers and engineers considering PV plant construction and ownership, documents PVUSA utility-scale system design and cost lessons learned. Complementary PVUSA topical reports document: construction and safety experience; five-year assessment of EMTs; validation of the Kerman 500-kW grid-support PV plant benefits; PVUSA instrumentation and data analysis techniques; procurement, acceptance, and rating practices for PV power plants; experience with power conditioning units and power quality.

23482 (DOE/AL/82993–22) **Phase II – Photovoltaics for Utility Scale Applications (PVUSA). Progress report.** Pacific Gas and Electric Co., San Ramon, CA (United States). Dept. of Research and Development. Jun 1995. 177p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-92AL82993. Order Number DE95014977. Source: OSTI; NTIS; GPO Dep.

Photovoltaics for Utility Scale Applications (PVUSA) is a national public-private partnership that is assessing and demonstrating the viability of utility-scale (US) photovoltaic (PV) electric generation systems and recent developments in PV module technology. This report updates the project's progress, reviews the status and performance of the various PV installations during 1994, summarizes key accomplishments and conclusions for the year, and outlines future work. The PVUSA project has five objectives. These are designed to narrow the gap between a large utility industry that is unfamiliar with PV and a small PV industry that is aware of a potentially large utility market but unfamiliar with how to meet its requirements. The objectives are: Evaluate the performance, reliability, and cost of promising PV modules and balance-of-system (BOS) components side by side at a single location; Assess PV system operation and maintenance in a utility setting; Compare US utilities hands-on experience in designing, procuring, and operating PV systems; and, Document and disseminate knowledge gained from the project.

23483 (ETDE-BR–0005) **Numerical simulation of photovoltaic power plant interconnected to a grid of electric energy.** Lyra, Francisco Jose Maciel. Pernambuco Univ., Recife, PE (Brazil). Dept. de Energia Nuclear. Nov 1992. 248p. (In Portugese). Order Number DE95789949. Source: OSTI; NTIS (US Sales Only).

This work aims at the development of a model which simulates a photovoltaic power plant interconnected to the electrical grid. The analysis evaluates the system performance during a typical day of each month. Three configurations of flat solar panels have been studied: fixed, tracking the sun along a North/South axis that nay be tilted relative to the horizontal plane and a two axes tracker. The incident radiation of the panels is evaluated through correlations that transform daily values into instantaneous data, taking into account the statistical characteristics of the solar radiation and the anisotropy of the diffuse radiation. The optical characteristics of the module are analyzed based upon the physical properties of the optical means that make up the module, including multiple reflections. Cell temperature is computed by means of a model that considers the heating of the cell and module glass covering as well as the principal mechanism of heat transfer, particularly those of ambient convective losses and radiation exchange. The model of the IV characteristics curve of the photovoltaic module permits to obtain its electrical output for all operational conditions. Matching losses in module in module interconnection are also considered. Finally the efficiency of the power condition subsystem as well as its operational characteristics are obtained. Analyzing the results of the proposed models against those produced by PV-ISRAEL programs permit to conclude on the validation of the present model simulation. Based on the developed model a whole new range of information can be gained in design and evaluation of the photovoltaic power generation potential as well as an auxiliary tool in the study of experimental photovoltaic systems. (author). 61 refs, 58 figs, 35 tabs

23484 (ETDE-BR–0006) **Small scale irrigation system using a CEC photovoltaic generator. Technical and economic analysis.** Silva Fraga, Antonio Nelson da. Pernambuco Univ., Recife, PE (Brazil). Dept. de Energia Nuclear. Dec 1989. 135p. (In Portugese). Order Number DE95789950. Source: OSTI; NTIS (US Sales Only).

This work evaluates the benefits brought about by the use of low ratio concentrators coupled to photovoltaic generators. The main application looked for is water pumping for irrigation purposes. Optimization techniques looking for cost reduction are also developed with the aim of making this technology a viable alternative for small farmers. The concentrator studied is of the compound elastic type, an approximation of ideal non-focal concentrators (CPC). The reflector walls are simply obtained by the elastic deformation of a metallic sheet, fact which considerably simplify the construction procedure. A system of 500 W integrated by four modules of four cavities each, was built and tested. It was determined its electric and hydraulic performance and for comparison basis it was also tested a flat plate PV system. Both systems show a similar performance although the CEC-PV equipment has half the surface of photocells of the flat panel. A numerical simulation model of CEC-PV, CPC-PV and flat plate systems, used for irrigation purposes, was developed. The model considers the interaction of local climate, PV generator, moto-pump load, soil and crop subsystems. The maximum surface which can be irrigated by the three configurations analysed are: 1.43 ha, 1.41 ha and 1.38 ha for flat plate, CEC-PV and CPC-PV, respectively. Also the costs of electric energy, volume pumped and irrigated surface were obtained. The CEC-PV presents substantial benefits concerning electric energy and pumped water costs. The cost of the irrigated hectare shows smaller differences between the three systems studied mainly because the larger the total investment, the smaller the incidence of the cost reduction of the PV generator. (author). 47 refs, 58 figs, 11 tabs

23485 (ETDE-DE–151) **Photovoltaic power supplies for environmental monitoring stations. Final report.** Schreitmueller, K.R.; Bermich, R.; Cornelius, C.; Decker, B.; Gentz, M. Institut fuer Solarenergieforschung GmbH, Emmerthal (Germany). Nov 1994. 69p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0329038A. Order Number DE95790557. Source: OSTI; NTIS (US Sales Only).

The conception of the photovoltaic supplied environmental monitoring station is in agreement with the Niedersaechsisches Landesamt fuer Oekologie, Forschungsstelle Kueste. In the first step the load energy demand (data acquisition unit, hydrological sensors for pressure and flow rate) is minimized. An important attempt is a load management, that reduces the switch-on periods of the sensors to a technically necessary extent. Because suitable hardware and software solutions are not available on the market, we develop a data acquisition and control device with low power demand. Due to the site of Norderney (North Sea coast of Lower

Saxony) and the corresponding solar radiation and load characteristics the autonomous photovoltaic power supply is designed by computer simulation. The selection and installation of components takes into account the specific site conditions (humidity, the tides, wind load). Several prototypes of the photovoltaic supplied environmental monitoring station are tested over a long time range. In the beginning we use a data storage, later a data transmission by the aid of a cordless telephone (C-Net). We develop an interface between the data acquisition and control device and the modem that is characterized by low power demand and switching capability due to modem and cordless telephone. The performed developments and prototype testings expand the area of application of autonomous photovoltaic supplied monitoring and control devices. (orig.)

23486 (ETDE-DE–166) **Climate-compatible energy supply in Baden-Wuerttemberg. Photovoltaic energy conversion - imports of solar electricity - hydrogen.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 17. Staiss, F. (Zentrum fuer Sonnenenergie- und Wasserstoff-Forschung (ZSW), Stuttgart (Germany)); Boehnisch, H.; Moesslein, J.; Pfisterer, F.; Stellbogen, D. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 179p. (In German). Order Number DE95790277. Source: OSTI; NTIS (US Sales Only).

This brochure is one of the progress reports of the "Academy of Technology Assessment in Baden-Wuerttemberg". It discusses the work on photovoltaic electricity generation and on imports of hydrogen-based solar electricity: 1. Solar power generation - photovoltaic systems - 2. Imports of solar electricity. (orig.)

23487 (ETDE-DE–169) **Preparation and management of the One Thousand Roofs Programme in Lower Saxony. Final report.** Decker, B.; Grochowski, J.; Jahn, U.; Mencke, D.; Tegtmeyer, D. Institut fuer Solarenergieforschung GmbH, Emmerthal (Germany). Dec 1994. 60p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0329208A. Order Number DE95790555. Source: OSTI; NTIS (US Sales Only).

The German "One Thousand Roofs Programme" is supporting the installations of roof-mounted photovoltaic systems in order to demonstrate the use of roof tops for decentral photovoltaic energy production. The Federal Ministry for Research and Technologie and the State of Lower Saxony are supporting 176 grid connected photovoltaic systems on the roofs of single and two-family houses in Lower Saxony. The aim of this project is the administrative and technical preparation and project management of the "One Thousand Roofs Programme" in Lower Saxony. During this work, 380 applications for support have been sighted, 176 of which have been selected and approved for support and 172 photovoltaic systems with a total capacity of 391,6 kWp have been technically inspected. Furthermore, operating experiences from the installed projects in Lower Saxony are gathered and monitored performance data are collected and analysed. The accompanying monitoring and evaluation programme will provide in valuable information on the energy yields, system performance and operational failures of grid connected photovoltaic systems for future projects. (orig.)

1407 Solar Thermal Power Systems

23488 (SAND–92-1449) **Design, fabrication, and testing of a sodium evaporator for the STM4-120 kinematic Stirling engine.** Rawlinson, K.S.; Adkins, D.R. Sandia National Labs., Albuquerque, NM (United States). May 1995. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015440. Source: OSTI; NTIS; GPO Dep.

This report describes the development and testing of a compact heat-pipe heat exchanger kW(e) designed to transfer thermal energy from hot combustion gases to the heater tubes of a 25-kW(e) Stirling engine. In this system, sodium evaporates from a surface that is heated by a stream of hot gases. The liquid metal then condenses on the heater tubes of a Stirling engine, where energy is transferred to the engine's helium working fluid. Tests on a prototype unit illustrated that a compact (8 cm x 13 cm x 16 cm) sodium evaporator can routinely transfer 15 kW(t) of energy at an operating vapor temperature of 760 C. Four of these prototype units were eventually used to power a 25-kW(e) Stirling engine system. Design details and test results from the prototype unit are presented in this report.

23489 (SAND–95-1106) **A nightly conditioning method to reduce parasitic power consumption in molten-salt central-receiver solar-power plants.** Pacheco, J.E. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950828–11: National heat transfer conference, Portland, OR (United States), 5-9 Aug 1995). Order Number DE95013030. Source: OSTI; NTIS; GPO Dep.

A method to reduce nightly parasitic power consumption in a molten salt central receiver is discussed where salt is drained from the piping and heat tracing is turned off to allow the piping to cool to ambient overnight, then in the morning the pipes are filled while they are cold. Since the piping and areas of the receiver in a molten-nitrate salt central-receiver solar power plant must be electrically heated to maintain their temperatures above the nitrate salt freezing point (430°F, 221°C), considerable energy could be used to maintain such temperatures during nightly shut down and bad weather. Experiments and analyses have been conducted to investigate cold filling receiver panels and piping as a way of reducing parasitic electrical power consumption and increasing the availability of the plant. The two major concerns with cold filling are: (1) how far can the molten salt penetrate cold piping before freezing closed and (2) what thermal stresses develop during the associated thermal shock. Experiments and analysis are discussed.

1409 Solar Thermal Utilization

23490 (ETDE-BR–0010) **Utilization of solar energy in the industry of ceramics for the drying process.** Bouckaert, Paul Henri Pimentel. Pernambuco Univ., Recife, PE (Brazil). Dept. de Energia Nuclear. Feb 1992. 151p. (In Portugese). Order Number DE95789954. Source: OSTI; NTIS (US Sales Only).

A solar system for brick drying used in ceramic industry is presented, consisting in a flat plate collector for air heating and a drying chamber. Some experiments for drying rate and critical moisture point determination are shown. Based in the experimental results, a simulation program is developed, considering the environmental conditions of temperature, relative air moisture and wind speed. The solar collectors of the proposed drying system are used for industrial drying of bricks, supplying air in suitable temperature to the process. 41 refs, 55 figs, 15 tabs

23491 (ETDE-DE–152) **Testing of simple solar preheaters with different auxiliary heating systems. Final report.** Schaube, H. Technischer Ueberwachungs-Verein Bayern Sachsen e.V., Muenchen (Germany). Zentralabteilung Energietechnische Anlagen und Systeme. Feb 1995. 109p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0329156D. Order Number DE95790893. Source: OSTI; NTIS (US Sales Only).

This study was a part of the researching project 'Solar und Sanitaer' (Nr. 0329156A), which was coordinated by 'Gesellschaft zur Foerderung der Heizungs- und Klimatechnik mbH'. (1) The reliability, safety and economic efficiency of seven low cost solar preheating systems have been tested during 20 months under real climatic conditions. (2) Four different auxiliary heating systems which have been connected to similar solar domestic hot water systems have been compared during a long term test. (3) The usability of five continuous flow heaters as auxiliary heating systems in solar domestic hot water systems was checked at a test facility where the special requirements for this purpose could be simulated. (HW)

23492 (ETDE-DE–165) **Climate-compatible energy supply in Baden-Wuerttemberg. Solar heat supply including industrial-scale heat storage facilities in Baden-Wuerttemberg.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 18. Nast, M. (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Stuttgart (Germany). Inst. fuer

Technische Thermodynamik); Nitsch, J. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 125p. (In German). Order Number DE95790276. Source: OSTI; NTIS (US Sales Only).

This brochure is one of the progress reports of the "Academy for Technology Assessment in Baden-Wuerttemberg". It reports on the project "Climate-compatible energy supply in Baden-Wuerttemberg". The report presents investigations of technologies for solar heat supply including industrial-scale solar heat storage systems: 1. Structural and energy-related basic data; 2. Reference technologies; Energy consumption during production and operation of the plant; 4. Potentials of solar thermal energy use; collector systems (assessment); 6. Obstacles to the introduction of solar thermal plants. (orig.)

1410 Solar Collectors and Concentrators

Refer also to citation(s) 23492

23493 (ETDE-BR–0008) **Design, construction and performance analysis of a compound parabolic concentrator. Simulation and experimental results.** Leao, Paulo Cesar Abreu. Minas Gerais Univ., Belo Horizonte, MG (Brazil). Escola de Engenharia. Mar 1989. 82p. (In Portugese). Order Number DE95789952. Source: OSTI; NTIS (US Sales Only).

Models of compound parabolic concentrators (CPC) were designed, built and experimentally analyzed from the thermal point of view. Three configurations were considered: a CPC with a glass cover and a tubular glass envelope, a CPC without the envelope but with the cover, and a CPC without either envelope or cover. A mathematical model is proposed, containing modifications to analyze the thermal process of the CPC under a steady state condition with and without a not evacuated tubular envelope. The experimental results are compared to those obtained from the mathematical model. Simulations are carried out in order to achieve the optimization of the prototype. (author). 31 refs, 32 figs

1420 Heat Storage

Refer also to citation(s) 23492, 23755

1430 Health and Safety

Refer also to citation(s) 23480

23494 (DOE/AL/82993–12) **Magnetic field survey at PG&E photovoltaic sites.** Chang, G.J.; Jennings, C. Pacific Gas and Electric Co., San Ramon, CA (United States). Dept. of Research and Development. Aug 1994. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-92AL82993. Order Number DE95013806. Source: OSTI; NTIS; GPO Dep.

Public awareness has aroused concerns over the possible effects of magnetic fields on human health. While research continues to determine if magnetic fields do, in fact, affect human health, concerned individuals are requesting data on magnetic field sources in their environments to base personal decisions about limiting their exposure to these sources. Timely acceptance and implementation of photovoltaics (PV), particularly for distributed applications such as PV rooftops, windows, and vehicles, may be hampered by the lack of PV magnetic field data. To address this situation, magnetic flux density was measured around equipment at two PVUSA (Photovoltaics for Utility Scale Applications) project sites in Kerman and Davis, California. This report documents the data and compares the PV magnetic fields with published data on more prevalent magnetic field sources. Although not comprehensive, electric and magnetic field (EMF) data taken at PVUSA indicate that 60-Hz magnetic fields (the EMF type of greatest public concern) are significantly less for PV arrays than for household applications. Therefore, given the present EMF research knowledge, PV array EMF may not merit considerable concern. The PV system components exhibiting significant AC magnetic fields are the transformers and power conditioning units (PCUs). However, the AC magnetic fields associated with these components are localized and are not detected at PV system perimeters. Concern about transformer and PCU EMF would apply to several generation and storage technologies.

15 GEOTHERMAL ENERGY

Refer also to citation(s) 24546

1501 Resources and Availability

Refer also to citation(s) 24747

1502 Geology and Hydrology of Geothermal Systems

23495 (USGS-OFR–94-586) **Chemistry of spring and well waters on Kilauea Volcano, Hawaii, and vicinity.** Janik, C.J.; Nathenson, M.; Scholl, M.A. Geological Survey, Menlo Park, CA (United States). 1994. 166p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-93OR22089. Order Number DE95013085. Source: OSTI; NTIS; GPO Dep.

Published and new data for chemical and isotopic samples from wells and springs on Kilauea Volcano and vicinity are presented. These data are used to understand processes that determine the chemistry of dilute meteoric water, mixtures with sea water, and thermal water. Data for well and spring samples of non-thermal water indicate that mixing with sea water and dissolution of rock from weathering are the major processes that determine the composition of dissolved constituents in water. Data from coastal springs demonstrate that there is a large thermal system south of the lower east rift of Kilauea. Samples of thermal water from shallow wells in the lower east rift and vicinity have rather variable chemistry indicating that a number of processes operate in the near surface. Water sampled from the available deep wells is different in composition from the shallow thermal water, indicating that generally there is not a significant component of deep water in the shallow wells. Data for samples from available deep wells show significant gradients in chemistry and steam content of the reservoir fluid. These gradients are interpreted to indicate that the reservoir tapped by the existing wells is an evolving vapor-dominated system.

1503 Geothermal Exploration and Exploration Technology

Refer also to citation(s) 23093

1506 Environmental Aspects

23496 (ORNL/TM–12863) **Environmental resources of selected areas of Hawaii: Ecological resources.** Trettin, C.C. (Oak Ridge National Lab., TN (United States). Environmental Sciences Div.); Tolbert, V.R.; Jones, A.T.; Smith, C.R.; Kalmijn, A.J. Oak Ridge National Lab., TN (United States). Mar 1995. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014186. Source: OSTI; NTIS; INIS; GPO Dep.

This report has been prepared to make available and archive the background scientific data and related information collected on ecological resources during the preparation of the environmental impact statement (EIS) for Phases 3 and 4 of the Hawaii Geothermal Project (HGP) as defined by the state of Hawaii in its April 1989 proposal to Congress. Since the state of Hawaii is no longer pursuing or planning to pursue the HGP, DOE considers the project to be terminated. The background scientific data and related information presented in this report focus on several areas of Hawaii County. In this report, reference is made to these areas as study areas rather than as areas where proposed or alternative facilities of the HGP would be located. The resource areas addressed herein include terrestrial ecology, aquatic ecology, and marine ecology. The scientific background data and related information that were obtained from review of the (1) scientific literature, (2) government and private sector reports, (3) studies done under DOE interagency agreements with the US Fish and Wildlife Service (FWS) and with the US Army Corps of Engineers (COE), and (4) observations made during site visits are being made available for future research in these areas.

1509 Geothermal Engineering

Refer also to citation(s) 23498

23497 (SAND–95-1289C) **Progress toward using hydraulic data to diagnose lost circulation zones.** Mansure, A.J.; Glowka, D.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951037–1: Annual meeting of the Geothermal Resources Council, Reno, NV (United States), 8-11 Oct 1995). Order Number DE95014851. Source: OSTI; NTIS; GPO Dep.

Several wellbore hydraulic models have been examined to determine their applicability in measuring the characteristics of lost circulation zones encountered in geothermal drilling. Characteristics such as vertical location in the wellbore, fracture size, effective permeability, and formation pressure must be known in order to optimize treatment of such zones. The models that have been examined to date are a steady-state model, a standpipe-pressure model, a raising-the-drill-bit model, a mud-weight model, a hydrofracture model, and several time-dependent models. None of these models yet have been found to adequately match the field data obtained from six loss zones in three geothermal wells. The development of these models is presented in this paper, and a discussion of their limitations is provided.

1520 Geothermal Data and Theory

Refer also to citation(s) 23930

23498 (CONF-950388–2) **Production and mitigation of acid chlorides in geothermal steam.** Simonson, J.M.; Palmer, D.A. Oak Ridge National Lab., TN (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States);Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC05-84OR21400. From 13. geothermal program review; San Francisco, CA (United States); 13-16 Mar 1995. Order Number DE95013351. Source: OSTI; NTIS; GPO Dep.

Measurements of the equilibrium distribution of relatively nonvolatile solutes between aqueous liquid and vapor phases have been made at temperatures to 350°C for HCl(aq) and chloride salts. These data are directly applicable to problems of corrosive-steam production in geothermal steam systems. Compositions of high-temperature brines which could produce steam having given concentrations of chlorides may be estimated at various boiling temperatures. Effects of mitigation methods (e.g., desuperheating) can be calculated based on liquid-vapor equilibrium constants and solute mass balances under vapor-saturation conditions.

1540 Waste Management

23499 (BNL–61285) **Biochemical technology for the detoxification of geothermal brines and the recovery of trace metals.** Premuzic, E.T.; Lin, M.S.; Lian, Hsienjen. Brookhaven National Lab., Upton, NY (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950955–1: 10. international conference on heavy metals in the environment, Hamburg (Germany), 18-22 Sep 1995). Order Number DE95011805. Source: OSTI; NTIS; GPO Dep.

Studies conducted at BNL, have shown that a cost-efficient and environmentally acceptable biochemical technology for detoxification of geothermal sludges is most satisfactory, as well as technically achievable. This technology is based on biochemical reactions by which certain extremophilic microorganisms interact with inorganic matrices of geothermal origin. The biochemical treatment of wastes generated by power plants using geothermal energy is a versatile technology adaptable to several applications beyond that of rendering hazardous and/or mixed wastes to non-hazardous by products, which meet regulatory requirements. This technology may be used for solubilization or recovery of a few metals to the isolation of many metals including radionuclides. In the metal recovery mode, an aqueous phase is generated which meets regulatory standards. The resulting concentrate contains valuable trace metals and salts which can be further converted into income generating products which can off-set the initial investment costs associated with the new biotechnology. In this paper, recent developments in this emerging technology will be discussed.

17 WIND ENERGY

1701 Resources and Availability (Climatology)

23500 (DOE/EIS–0206-App.C) **A cultural resources study of the proposed CARES Columbia Wind Farm No. 1, Klickatat County, Washington. Appendix C.** Galm, J.R.; Boreson, K.; Crisson, F.; Holstine, C. USDOE, Washington, DC (United States). Feb 1995. 21p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012242. Source: OSTI; NTIS; GPO Dep.

The purpose of this study is to conduct a cultural resources inventory to provide information for the environmental impact statement being jointly prepared by BPA and Klickatat County, Washington.

23501 (ETDE-BR–0012) **Probabilistic distributions of wind velocity for the evaluation of the wind power potential.** Vendramini, Elisa Zanuncio. UNESP, Botucatu, SP (Brazil). Faculdade de Ciencias Agronomicas. Oct 1986. 117p. (In Portugese). Order Number DE95789956. Source: OSTI; NTIS (US Sales Only).

The theoretical model of wind speed distributions allow valuable information about the probability of events relative to the variable in study eliminating the necessity of a new experiment. The most used distributions has been the Weibull and the Rayleigh. These distributions are examined in the present investigation, as well as the exponential, gamma, chi square and lognormal distributions. Three years of hourly averages wind data recorded from a anemometer setting at the city of Ataliba Leonel, Sao Paulo State, Brazil, were used. Using wind speed distribution the theoretical relative frequency was calculated from the distributions which have been examined. Results from the Kolmogorov - Smirnov test allow to conclude that the lognormal distribution fit better the wind speed data, followed by the gamma and Rayleigh distributions. Using the lognormal probability density function the yearly energy output from a wind generator installed in the side was calculated. 30 refs, 4 figs, 14 tabs

1704 Economic, Industrial, and Business Aspects

Refer also to citation(s) 23506

1705 Environmental Aspects

23502 (DOE/EIS–0206-App.B) **Columbia Wind Farm #1 EIS: Botanical resources technical report for the Conservation and Renewable Energy System. Appendix B.** Jones and Stokes Associates, Inc., Bellevue, WA (United States). 3 Feb 1995. 43p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012241. Source: OSTI; NTIS; INIS; GPO Dep.

Jones and Stokes Associates conducted botanical investigations of the Conservation and Renewable Energy Systems (CARES) project site from April through July 1994. Presurvey investigations were conducted to gain information regarding potential special-status plant species and vegetation communities that might exist on the project area. Field surveys were conducted to determine the presence of special-status plant species, map and describe potential vegetation communities, and document the presence of other species onsite, including culturally important species. Field surveys also were used to identify possible mitigation measures as a means to reduce potential project impacts to botanical resources. Floristically, the project area is located in the Columbia Basin Province dominated by shrub-steppe grassland vegetation. Completion of the presurvey and field investigations documented that the project area is dominated by native bunchgrass communities. Field surveys also determined that no special-status plant species were found on the study area. Implementation of the project would result in moderately significant impacts to the vegetation resource.

Impacts include the following direct impacts: removal or disturbance of approximately 38 hectares (95 acres) of vegetation, including 32 hectares (80 acres) of native, natural communities, from project construction and the initiation of development into relatively undisturbed native vegetation communities. Indirect impacts to vegetation are associated with impacts that could occur in the future. Ongoing activities that are required to maintain the site's function of producing wind power could result in vegetation trampling and removal of vegetation. This disturbance could create areas where invasive weeds could establish and provide a continual source of weed seed in the project area.

23503 (DOE/EIS–0206-App.D) **Avian use of proposed KENETECH and CARES wind farm sites in Klickitat County, Washington: Technical report. Appendix D.** Jones and Stokes Associates, Inc., Bellevue, WA (United States). 31 Jan 1995. 309p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012243. Source: OSTI; NTIS; INIS; GPO Dep.

The Columbia Hills area above (north of) the Columbia River in Klickitat County, in southcentral Washington, is being considered for development of two wind power generation projects that could include the eventual placement of up to 436 wind turbines. The KENETECH Windpower Washington Windplant™ Number 1 project would include placing up to 345 KENETECH 33M-VS turbines, capable of producing up to 115 megawatts (MW), in 39 rows (strings) on a 5,110-hectare (12,630-acre) site. The Conservation and Renewable Energy Systems (CARES) Columbia Wind Farm # 1 project would include placing 91 Flowind AWT-26 turbines, capable of generating 25 MW, in 11 rows on a 395-hectare (975-acre) site. During scoping for these proposed developments, concerns were raised regarding the potential for avian mortality associated with wind farm development. Collision with wind turbine blade, towers, guy wires, and transmission lines, and electrocution from power lines have been identified as sources of avian mortality, particularly raptors, at existing wind farm facilities. To address these concerns, an avian study was conducted at the site in accordance with an avian study plan and protocol developed, with input from a national avian task force, state agencies (Washington Department of Fish and Wildlife [WDFW]), and federal agencies (USFWS). The study included four elements: (1) a winter raptor and waterfowl study, (2) spring migration and fall migration studies, (3) a summer resident study, and (4) a raptor breeding study. The study involved extensive field studies conducted by biologists experienced in identifying raptors and other birds.

23504 (ETDE-DE–162) **Climate-compatible energy supply in Baden-Wuerttemberg. Wind power utilisation.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 19. Wiese, A. (Stuttgart Univ. (Germany). Inst. fuer Energiewirtschaft und Rationelle Energieanwendung (IER)); Albiger, J.; Kaltschmitt, M.; Fahl, U. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 90p. (In German). Order Number DE95790274. Source: OSTI; NTIS (US Sales Only).

This brochure is one of the progress reports of the "Academy of Technology Assessment in Baden-Wuerttemberg". It attempts to point out the potential and limits of wind power in Baden-Wuerttemberg. In addition, the necessary technical, economic, ecological and other key data are made available for the projected scenario analysis which is based on the political goal of a 30% CO_2 reduction by the year 2005. (orig.)

23505 (NREL/TP–441-7821) **A pilot golden eagle population study in the Altamont Pass Wind Resource Area, California.** Hunt, G. (California Univ., Santa Cruz, CA (United States). Predatory Bird Research Group). National Renewable Energy Lab., Golden, CO (United States); California Univ., Santa Cruz, CA (United States). Predatory Bird Research Group. May 1995. 219p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009220. Source: OSTI; NTIS; GPO Dep.

Orloff and Flannery (1992) estimated that several hundred reports are annually killed by turbine collisions, wire strikes, and electrocutions at the Altamont Pass Wind Resource Area (WRA). The most common fatalities were those of red-tailed hawks (Buteo jamaicensis), American kestrels (Falco sparvatius), and golden eagles (Aquila chrysaetos), with lesser numbers of turkey vultures (Cathartes aura), common ravens (Corvus corax), barn owls (Tyto alba), and others. Among the species of raptors killed at Altamont Pass, the one whose local population is most likely to be impacted is the golden eagle. Besides its being less abundant than the others, the breeding and recruitment rates of golden eagles are naturally slow, increasing their susceptibility to decline as a result of mortality influences. The golden eagle is a species afforded special federal protection because of its inclusion within the Bald Eagle Protection Act as amended in 1963. There are no provisions within the Act which would allow the killing "taking" of golden eagles by WRA structures. This report details the results of field studies conducted during 19941. The primary purpose of the investigation is to lay the groundwork for determining whether or not turbine strikes and other hazards related to energy at Altamont Pass may be expected to affect golden eagles on a population basis. We also seek an understanding of the physical and biotic circumstances which attract golden eagles to the WRA within the context of the surrounding landscape and the conditions under which they are killed by wind turbines. Such knowledge may suggest turbine-related or habitat modifications that would result in a lower incidence of eagle mortality.

1706 Wind Energy Engineering

23506 (ETDE-DE–108) **Wind power in Berlin.** BEWAG Fachreport, v. 1994/1. Kraemer, K.; Pokojski, M. Berliner Kraft- und Licht (BEWAG)-AG, Berlin (Germany). Mar 1994. 8p. (In German). Order Number DE95778125. Source: OSTI; NTIS (US Sales Only).

The brochure describes a wind power project. The wind converter has two asynchronous generators of 6 kW and 30 kW, respectively. It is located on a landfill site near Berlin. The power generation per month is presented in a diagram. (orig.)

23507 (NREL/TP–441-7808) **Optimizing small wind turbine performance in battery charging applications.** Drouilhet, S. (National Renewable Energy Lab., Golden, CO (United States). Wind Technology Div.); Muljadi, E.; Holz, R.; Gevorgian, V. National Renewable Energy Lab., Golden, CO (United States). May 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. (CONF-950309–8: 25. annual conference and exhibition on wind power, Washington, DC (United States), 26-30 Mar 1995). Order Number DE95009211. Source: OSTI; NTIS; GPO Dep.

Many small wind turbine generators (10 kW or less) consist of a variable speed rotor driving a permanent magnet synchronous generator (alternator). One application of such wind turbines is battery charging, in which the generator is connected through a rectifier to a battery bank. The wind turbine electrical interface is essentially the same whether the turbine is part of a remote power supply for telecommunications, a standalone residential power system, or a hybrid village power system, in short, any system in which the wind generator output is rectified and fed into a DC bus. Field experience with such applications has shown that both the peak power output and the total energy capture of the wind turbine often fall short of expectations based on rotor size and generator rating. In this paper, the authors present a simple analytical model of the typical wind generator battery charging system that allows one to calculate actual power curves if the generator and rotor properties are known. The model clearly illustrates how the load characteristics affect the generator output. In the second part of this paper, the authors present four approaches to maximizing energy capture from wind turbines in battery charging applications. The first of these is to determine the optimal battery bank voltage for a given WTG. The second consists of adding capacitors in series with the generator. The third approach is to place an optimizing DC/DC voltage converter between the rectifier and the battery bank. The fourth is a combination of the series capacitors and the optimizing voltage controller. They also discuss both the limitations and the potential performance gain associated with each of the four configurations.

23508 (NREL/TP–442-7110) **Advanced system identification techniques for wind turbine structures with special**

emphasis on modal parameters. Bialasiewicz, J.T. National Renewable Energy Lab., Golden, CO (United States). Jun 1995. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009251. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop advanced system identification techniques that can be used to accurately measure the frequency response functions of a wind-turbine structure immersed in wind noise. To allow for accurate identification, the authors have developed a special test signal called the Pseudo-Random Binary Sequence (PRBS). The Matlab program that generates this signal allows the user to interactively tailor its parameters for the frequency range of interest based on the response of the wind turbine under test. By controlling NREL's Mobile Hydraulic Shaker System, which is attached to the wind turbine structure, the PRBS signal produces the wide-band excitation necessary to perform system identification in the presence of wind noise. The techniques presented here will enable researchers to obtain modal parameters from an operating wind turbine, including frequencies, damping coefficients, and mode shapes. More importantly, the algorithms they have developed and tested (so far using input-output data from a simulated structure) permit state-space representation of the system under test, particularly the modal state space representation. This is the only system description that reveals the internal behavior the system, such as the interaction between the physical parameters, and which, in contrast to transfer functions, is valid for non-zero initial conditions.

23509 (NREL/TP–442-7812) **Guidelines for reducing dynamic loads in two-bladed teetering-hub downwind wind turbines.** Wright, A.D.; Bir, G.S.; Butterfield, C.D. National Renewable Energy Lab., Golden, CO (United States). Jun 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009252. Source: OSTI; NTIS; GPO Dep.

A major goal of the federal Wind Energy Program is the rapid development and validation of structural models to determine loads and response for a wide variety of different wind turbine configurations operating under extreme conditions. Such codes are crucial to the successful design of future advanced wind turbines. In previous papers the authors described steps they took to develop a model of a two-bladed teetering-hub downwind wind turbine using ADAMS® (Automatic Dynamic Analysis of Mechanical Systems), as well as comparison of model predictions to test data. In this paper they show the use of this analytical model to study the influence of various turbine parameters on predicted system loads. They concentrate their study on turbine response in the frequency range of six to ten times the rotor rotational frequency (6P to 10P). Their goal is to identify the most important parameters which influence the response of this type of machine in this frequency range and give turbine designers some general design guidelines for designing two-bladed teetering-hub machines to be less susceptible to vibration. They study the effects of such parameters as blade edgewise and flapwise stiffness, tower top stiffness, blade tip-brake mass, low-speed shaft stiffness, nacelle mass momenta of inertia, and rotor speed. They show which parameters can be varied in order to make the turbine less responsive to such atmospheric inputs as wind shear and tower shadow. They then give designers a set of design guidelines in order to show how these machines can be designed to be less responsive to these inputs.

23510 (NREL/TP–442-7813) **Development of an advanced system identification technique for comparing ADAMS analytical results with modal test data for a MICON 65/13 wind turbine.** Bialasiewicz, J.T. National Renewable Energy Lab., Golden, CO (United States). Jul 1995. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009260. Source: OSTI; NTIS; GPO Dep.

This work uses the theory developed in NREL/TP–442-7110 to analyze simulated data from an ADAMS (Automated Dynamic Analysis of Mechanical Systems) model of the MICON 65/13 wind turbine. The Observer/Kalman Filter identification approach is expanded to use input-output time histories from ADAMS simulations or structural test data. A step by step outline is offered on how the tools developed in this research, can be used for validation of the ADAMS model.

23511 (PNL–10630) **A simple method of estimating wind turbine blade fatigue at potential wind turbine sites.** Barnard, J.C.; Wendell, L.L. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015265. Source: OSTI; NTIS; GPO Dep.

This paper presents a technique of estimating blade fatigue damage at potential wind turbine sites. The cornerstone of this technique is a simple model for the blade's root flap bending moment. The model requires as input a simple set of wind measurements which may be obtained as part of a routine site characterization study. By using the model to simulate a time series of the root flap bending moment, fatigue damage rates may be estimated. The technique is evaluated by comparing these estimates with damage estimates derived from actual bending moment data; the agreement between the two is quite good. The simple connection between wind measurements and fatigue provided by the model now allows one to readily discriminate between damaging and more benign wind environments.

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2001 Power Plants and Power Generation

Refer also to citation(s) 22979, 22982, 22985, 23027, 23571, 23646, 23727, 23742, 23865, 23889, 24967

23512 (CONF-941089–Vol.2, pp. 693-701) **Helping to reduce turbomachinery losses through advanced technology and online expertise.** Feigel, R.E. (Hartford Steam Boiler Inspection & Insurance Co., Hartford, CT (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

It's clear that turbomachinery poses a set of unique problems for risk managers. The size of the equipment, the role it often takes in production and the severity of a loss all combine to make a risk manager's job that much more difficult. But while the job may be difficult, it's not impossible. Through a combination of advanced technology, regular predictive maintenance and some expert advice, today's risk managers, working with plant operational personnel, are reducing major turbomachinery losses. There are several telltale signs that warn plant personnel of an impending turbomachinery failure. One is vibration. All turbomachinery will vibrate at some level, even when in good working condition. But a change in the vibration level usually indicates a change in the machine's performance. If plant personnel can detect a change early enough, they may be able to avoid an unscheduled shutdown. Hartford Steam Boiler recently introduced a periodic vibration data collection program called DATALERT™ to help its customers separate problem from non-problem machines. As a result, companies can focus resources on equipment that needs immediate attention. And equipment in good working condition doesn't tie up resources unnecessarily at the next maintenance turnaround. DATALERT is an integrated machinery vibration data collecting and expert analysis system developed by Hartford Steam Boiler to assist customers in preventing rotating machine downtime or losses. The data collection program is described.

23513 (CONF-941089–Vol.2, pp. 899-966) **Electric utility system benefits of factory packaged GE LM Modular Generator sets.** West, G. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

Electric utility system benefits of factory packaged GE LM modular generator sets are outlined. The following topics are discussed: GE LM gas turbine history, operating experience, maintenance, gas turbine spare engines, modular gas turbine generator sets, typical LM2500 cogeneration plant and STIG cycle plant, factory packaging concept, gas turbine/generator package, performance, comparison, competitive capital cost, phased construction, comparison of revenue requirements, capacity evaluation, heat rate evaluation, fuel evaluation, startup, and dispatch flexibility without maintenance penalty.

23514 (CONF-950564–9) **The plant-window system.** Wood, R.T. (Oak Ridge National Lab., TN (United States)); Mullens, J.A.; Naser, J.A. Oak Ridge National Lab., TN (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States);Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC05-84OR21400. From 9. symposium on power plant dynamics, control and testing; Knoxville, TN (United States); 24-26 May 1995. Order Number DE95013975. Source: OSTI; NTIS; INIS; GPO Dep.

Power plant data, and the information that can be derived from it, provide the link to the plant through which the operations, maintenance and engineering staff understand and manage plant performance. The increasing use of computer technology in the U.S. nuclear power industry has greatly expanded the capability to obtain, analyze, and present data about the plant to station personnel. However, it is necessary to transform the vast quantity of available data into clear, concise, and coherent information that can be readily accessed and used throughout the plant. This need can be met by an integrated computer workstation environment that provides the necessary information and software applications, in a manner that can be easily understood and used, to the proper users throughout the plant. As part of a Cooperative Research and Development Agreement with the Electric Power Research Institute, the Oak Ridge National Laboratory has developed functional requirements for a Plant-Wide Integrated Environment Distributed On Workstations (Plant-Window) System. The Plant-Window System (PWS) can serve the needs of operations, engineering, and maintenance personnel at nuclear power stations by providing integrated data and software applications (e.g., monitoring, analysis, diagnosis, and control applications) within a common environment. The PWS requirements identify functional capabilities and provide guidelines for standardized hardware, software, and display interfaces to define a flexible computer environment that permits a tailored implementation of workstation capabilities and facilitates future upgrades.

23515 (DOE/EE/15623–T1) **Clean energy from municipal solid waste. ERIP technical progress report No. 1.** Klosky, M. EnerTech Environmental, Inc., Atlanta, GA (United States). Engineering Group. 14 Jul 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-95EE15623. Order Number DE95014975. Source: OSTI; NTIS; GPO Dep.

Just prior to this award and reporting period but as part of this program, EnerTech initiated preliminary pilot scale slurry carbonization experiments with Refuse Derived Fuel (RDF) and preliminary pilot scale combustion experiments with the carbonized RDF slurry fuel. For this award and the time period April 1995–July 1995, several modifications to the pilot plant facilities were completed to improve operational reliability, system performance, and characteristics of the carbonized slurry fuel, based upon the previous plant experiments.

23516 (DOE/MC/29309–4056) **Tracy Power Station – Unit No. 4, Pinon Pine Power Project Public Design Report.** Sierra Pacific Power Co., Reno, NV (United States). Dec 1994. 183p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC29309. Order Number DE95009708. Source: OSTI; NTIS; GPO Dep.

This Public Design Report describes the Pinon Pine Project which will be located at the Sierra Pacific Power Company's (SPPCO) Tracy Station near Reno, Nevada. The integrated gasification combined-cycle (IGCC) plant is designed to process 880 tones per day (TPD) of bituminous coal producing approximately 107 gross megawatts of electric power (MWe). This project is receiving cost-sharing from the US Department of Energy (DOE) in accordance with DOE Cooperative Agreement DE-FC2192MC29309. The plant incorporates the Kellogg-Rust-Westinghouse (KRW) fluidized bed gasification technology which produces a low-Btu gas which is used as fuel in a combined cycle power plant which has been modified to accommodate the fuel gas produced by an air-blown gasifier. The gasification system also includes hot gas removal of particulates and sulfur compounds from the fuel gas resulting in a plant with exceptionally low atmospheric emissions. Desulfurization is accomplished by a combination of limestone injection into the KRW fluidized bed gasifier and by a transport reactor system. Particulate removal is accomplished by high efficiency cyclones and a barrier filter. The Pinon Pine Project Schedule is divided into three phases. Phase I includes permitting and preliminary design. Phase II, which overlaps Phase I, covers detailed design, procurement, and construction. Phase III will cover the initial operation and demonstration portion of the project.

23517 (DOE/MC/29309–4063) **Pinon Pine Power Project. Annual report, August 1992–December 1993.** Sierra Pacific Power Co., Reno, NV (United States). Nov 1994. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC29309. Order Number DE95009709. Source: OSTI; NTIS; GPO Dep.

This annual report has been prepared to present the status of the Pinon Pine Power Project, a nominal 104 MWe (gross) integrated gasification combined-cycle (IGCC) power plant addition to Sierra Pacific Power Company's (SPPCo) system. This project will also serve as a demonstration project cost-shared by the US Department of Energy (DOE) and SPPCo under DOE's Clean Coal Technology (CCT) Program. The goal of the CCT Program is to demonstrate advanced coal utilization technologies that are energy efficient and reliable and that are able to achieve substantial reductions in emissions as compared with existing coal technologies. The Pinon Pine Power Project will demonstrate an IGCC system utilizing the Kellogg-Rust-Westinghouse (KRW) fluidized-bed gasification process operating in an air-blown mode with in-bed desulfurization and hot gas clean-up with a western bituminous coal. The Pinon Pine Power Project will be constructed and operated at SPPCo's Tracy Power Station, an existing power generation facility located on a rural 724-acre plot approximately 17 miles east of Reno, NV.

23518 (DOE/MC/31327–95/C0451) **Externally-fired combined cycle: An effective coal fueled technology for repowering and new generation.** Stoddard, L.E. (Black and Veatch, Kansas City, MO (United States)); Bary, M.R.; Gray, K.M.; LaHaye, P.G. Black and Veatch, Kansas City, MO (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-94MC31327. (CONF-950313–2: 20. international technical conference on coal utilization and fuels systems, Clearwater, FL (United States), 20-23 Mar 1995). Order Number DE95012295. Source: OSTI; NTIS; GPO Dep.

The Externally-Fired Combined Cycle (EFCC) is an attractive emerging technology for powering high efficiency combined gas and steam turbine cycles with coal or other ash bearing fuels. In the EFCC, the heat input to a gas turbine is supplied indirectly through a ceramic air heater. The air heater, along with an atmospheric coal combustor and ancillary equipment, replaces the conventional gas turbine combustor. A steam generator located downstream from the ceramic air heater and steam turbine cycle, along with an exhaust cleanup system, completes the combined cycle. A key element of the EFCC Development Program, the 25 MMBtu/h heat-input Kennebunk Test Facility (KTF), has recently begun operation. The KTF has been operating with natural gas and will begin operating with coal in early 1995. The US Department of Energy selected an EFCC repowering of the Pennsylvania Electric Company's Warren Station for funding under the Clean Coal Technology Program Round V. The project focuses on repowering an existing 48 MW (gross) steam turbine with an EFCC power island incorporating a 30 MW gas turbine, for a gross power output of 78 MW and a net output of 72 MW. The net plant heat rate will be decreased by approximately 30% to below 9,700 Btu/kWh. Use of a dry scrubber and fabric filter will reduce sulfur dioxide (SO_2) and particulate emissions to levels under those required by the Clean Air Act Amendments (CAAA) of 1990. Nitrogen

oxides (NO_x) emissions are controlled by the use of staged combustion. The demonstration project is currently in the engineering phase, with startup scheduled for 1997. This paper discusses the background of the EFCC, the KTF, the Warren Station EFCC Clean Coal Technology Demonstration Project, the commercial plant concept, and the market potential for the EFCC.

23519 (DOE/PC/91155–T10) **Coal-fired high performance power generating system. Quarterly progress report, October 1, 1994–December 31, 1994.** United Technologies Corp., East Hartford, CT (United States). Research Center. [1995]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC91155. Order Number DE95015617. Source: OSTI; NTIS; GPO Dep.

This report covers work carried out under Task 3, Preliminary R and D, under contract DE-AC22-92PC91155, "Engineering Development of a Coal-Fired High Performance Power Generation System" between DOE Pittsburgh Energy Technology Center and United Technologies Research Center. The goals of the program are to develop a coal-fired high performance power generation system (HIPPS) by the year 2000 that is capable of (1) > 47% thermal efficiency; (2) NO_x, SO_x and particulates $\leq$25% NSPS; (3) cost $\geq$65% of heat input; (4) all solid wastes benign. In our design consideration, we have tried to render all waste streams benign and if possible convert them to a commercial product. It appears that vitrified slag has commercial values. If the flyash is reinjected through the furnace, along with the dry bottom ash, then the amount of the less valuable solid waste stream (ash) can be minimized. A limitation on this procedure arises if it results in the buildup of toxic metal concentrations in either the slag, the flyash or other APCD components. We have assembled analytical tools to describe the progress of specific toxic metals in our system. The outline of the analytical procedure is presented in the first section of this report. The strengths and corrosion resistance of five candidate refractories have been studied in this quarter. Some of the results are presented and compared for selected preparation conditions (mixing, drying time and drying temperatures). A 100 hour pilot-scale stagging combustor test of the prototype radiant panel is being planned. Several potential refractory brick materials are under review and five will be selected for the first 100 hour test. The design of the prototype panel is presented along with some of the test requirements.

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Refer also to citation(s) 22985, 23004, 23005, 23006, 23007, 23008, 23009, 23010, 23011, 23012, 23013, 23014, 23015, 23017, 23018, 23019, 23517, 23519

23520 (ANL/ES/CP–84609) **Development of dry control technology for emissions of mercury in flue gas.** Huang, Hann S.; Wu, Jiann M.; Livengood, C.D. Argonne National Lab., IL (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950647–1: 4. international congress on toxic combustion byproducts, Berkeley, CA (United States), 5-7 Jun 1995). Order Number DE95013530. Source: OSTI; NTIS; GPO Dep.

In flue gases from coal-combustion systems, mercury in either the elemental state or its chloride form ($HgCl_2$) can be predominant among all the possible mercury species present; this predominance largely depends on the chlorine-to-mercury ratio in the coal feeds. Conventional flue-gas cleanup technologies are moderately effective in controlling $HgCl_2$ but are very poor at controlling elemental mercury. Experiments were conducted on the removal of elemental mercury vapor by means of a number of different types of sorbents, using a fixed-bed adsorption system. Of the four commercial activated carbons evaluated, the sulfur-treated carbon sample gives the best removal performance, with good mercury-sorption capacities. Promising removal results also have been obtained with low-cost minerals after chemical treatments. These inorganic sorbents could potentially be developed into a cost-effective alternative to activated carbons for mercury removal.

23521 (CONF-9410335–, pp. 258-271) **Reducing NO_x emissions and improving efficiency using synthetic intelligence to manage boiler parameters.** Moreno, C.W. (Ultramax Corporation, Cincinnati, OH (United States)); Yunker, S.B. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Existing fossil-fired electric power generation systems can operate with significantly lower levels of NO_x and other undesirable emissions, while maintaining or improving heat rate, by optimizing adjustments to the input/control parameters of the combustion system. This is being achieved in about ten shifts of regular operations with Sequential Process Optimization (SPO) technology, without capital expenditures, historical data or prior models. As measurements or calculations of critical outputs are available, SPO sequentially provides advices for adjustment to input parameters in order to converge toward the optimum, and thereafter maintain it. The ULTRAMAX SPO is based on unique statistical and mathematical methods to sequentially: (1) generate new knowledge (prediction models for all outputs) from sequential operating data, and (2) sequentially define new input adjustments through synthesis with the integration of these models, to achieve overall process performance improvements. The SPO Technology is part of the ULTRAMAX Method, which includes a complete strategy for achieving multiple objectives tailored to fit the specifics of each operation, and defining personnel procedures. At an engineering level it provides for sensitivity analyses to understand certain bottlenecks which may be worth resolving through retrofits. This solution, in part co-developed by EPRI, was introduced into the power industry in late '93 after a variety of validation studies. Since then there have been a series of commercial applications with U.S. utility companies, where ROI's have been in the order of one month. Six case studies are presented which have various combinations of objectives such as reduction in NO_x, CO, opacity, LOI and Heat Rates.

23522 (DOE/PC/91338–T10) **High SO_2 removal efficiency testing.** Radian Corp., Austin, TX (United States). 10 Mar 1995. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC91338. Order Number DE95016678. Source: OSTI; NTIS; GPO Dep.

Tests were conducted on the Tampa Electric Company's (TECo) Big Bend Station, Unit 4 flue gas desulfurization (FGD) system to evaluate an option for achieving high sulfur dioxide (SO_2) removal efficiencies. The option tested was the addition of dibasic acid (DBA) additive. In addition, the effectiveness of other potential options was simulated with the Electric Power Research Institute's (EPRI) FGD PRocess Integration and Simulation Model (FGDPRISM) after it was calibrated to the system. An economic analysis was conducted to determine the cost effectiveness of each option considered.

23523 (DOE/PC/91344–T11) **Advanced separation technology for flue gas cleanup. Quarterly technical report Number 12.** Bhown, A.S. (SRI International, Menlo Park, CA (United States)); Alvarado, D.; Pakala, N.; Riggs, T.; Tagg, T.; Ventura, S.; Sirkar, K.K.; Majumdar, S.; Bhaumick, D. SRI International, Menlo Park, CA (United States). Apr 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC91344. Order Number DE95014328. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to develop a novel system for regenerable SO_2 and NO_x scrubbing of flue gas that focuses on (a) a novel method for regeneration of spent SO_2 scrubbing liquor and (b) novel chemistry for reversible absorption of NO_x. In addition, high efficiency hollow fiber contactors (BFC) are proposed as the devices for scrubbing the SO_2 and NO_x from the flue gas. The system will be designed to remove more than 95% of the SO_x and more than 75% of the NO_x from flue gases typical of pulverized coal-fired power plants at a cost that is at least 20% less than combined wet limestone scrubbing of SO_x and selective catalytic reduction of NO_x. In addition, the process will make only marketable byproducts, if any (no waste streams). During the first

quarter of 1995, the authors continued work on Task 8, and also began working on Task 9. In Task 8, they have presented the modified experimental arrangement for testing the efficacy of Co(II)-phthalocyanine solution for NO_x absorption as well as desorption over extended periods of time. The key feature of this new experimental setup is to continuously circulate the warm Co(II)-phthalocyanine solution (using a computer) through the HFC in order to avoid precipitation within the fibers. Also, this arrangement allows one to automatically acquire process data. In Task 9, the authors carried out preliminary design calculations to determine the performance of a rectangular module that will be supplied by Setec. Also, they designed and constructed the apparatus for testing these modules.

23524 (DOE/PC/91346–10) **Development of the integrated environmental control model: Performance model for the NOXSO process. Quarterly progress report.** Kalagnanam, J.R.; Rubin, E.S. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Center for Energy and Environmental Studies. Apr 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC91346. Order Number DE95015602. Source: OSTI; NTIS; GPO Dep.

In its current configuration, the IECM provides a capability to model various conventional and advanced processes for controlling air pollutant emissions from coal-fired power plants before, during, or after combustion. The principal purpose of the model is to calculate the performance, emissions, and cost of power plant configurations employing alternative environmental control methods. The model consists of various control technology modules, which may be integrated into a complete utility plant in any desired combination. In contrast to conventional deterministic models, the IECM offers the unique capability to assign probabilistic values to all model input parameters, and to obtain probabilistic outputs in the form of cumulative distribution functions indicating the likelihood of different costs and performance results. The most recent version of the IECM, implemented on a MacIntosh II computer, was delivered to DOE/PETC at the end of the last contract in May 1991. The current contract will continue the model development effort to provide DOE/PETC with improved model capabilities, including new software developments to facilitate model use and new technical capabilities for analysis of environmental control technologies. Integrated environmental control systems involving pre-combustion, combustion, and post-combustion control methods will be considered. Phase I involves developing the existing modules of the IECM. Phase II deals with creating new technology modules, linking the IECM with PETC databases, and training PETC personnel on the use of the updated models. The present report summarizes recent progress on the Phase I effort during the period January 1 - March 31, 1995. A preliminary summary is given of the new performance model developed for the NOXSO process. The performance model is developed from first principles and parametrized based on experimental data from pilot plants.

23525 (OCDO–95012719) **Development of advanced, dry, SO_x/NO_x emission control technologies for high-sulfur coal. Final report, April 1, 1993–December 31, 1994.** Amrhein, G.T. Babcock and Wilcox Co., Alliance, OH (United States). 23 Dec 1994. 89p. Sponsored by Ohio State Government, Columbus, OH (United States). Source: OSTI; Ohio Coal Development Office, 77 S. High Street, P.O. Box 1001, Columbus, OH 43266-0001 (United States).

Dry Scrubbing is a common commercial process that has been limited to low- and medium-sulfur coal applications because high-sulfur coal requires more reagent than can be efficiently injected into the process. Babcock & Wilcox has made several advances that extend dry scrubbing technologies to higher sulfur coals by allowing deposit-free operation at low scrubber exit temperatures. This not only increases the amount of reagent that can be injected into the scrubber, but also increases SO_2 removal efficiency and sorbent utilization. The objectives of this project were to demonstrate, at pilot scale, that advanced, dry-scrubbing-based technologies can attain the performance levels specified by the 1990 Clean Air Act Amendments for SO_2 and NO_x emissions while burning high-sulfur coal, and that these technologies are economically competitive with wet scrubber systems. The use of these technologies by utilities in and around Ohio, on new or retrofit applications, will ensure the future of markets for high-sulfur coal by creating cost effective options to coal switching.

2005 Environmental Aspects

Refer also to citation(s) 23519, 23732

2006 Economic, Industrial, and Business Aspects

Refer also to citation(s) 23732

23526 (CONF-941089–Vol.2, pp. 711-760) **Competitive power development.** Garrity, T.F. (GE Power Systems Engineering, Schenectady, NY (United States)); Stoll, H.G. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

Electric power is essential to economic growth and the improvement in the standard of living in modern societies. Maximizing the overall economic efficiency of electric power production can lead to even stronger economic growth. Overall electricity efficiency can be driven by utilization of the newest and most economically efficient technologies, utilization of the most efficient financial structuring, and efficient integration of coproduction of electricity and process energy. The challenge is to drive the power generation strategy toward maximum economic efficiency while improving the overall country environment emissions. This paper reviews the key power generation technologies available today and in the near future. Of key importance is the capital cost, efficiency, environmental impacts, and reliability of each technology and how these technologies can be integrated with efficient financial structurings to maximize the country power generation economic efficiency. Examples of several countries are used to show recent successes in maximizing economic efficiency.

23527 (CONF-941089–Vol.2, pp. 761-776) **HANJUNG's overseas marketing for power industry.** Cho, B.K. (Korea Heavy Industries and Construction Co., Ltd., Hanjung (Korea, Democratic People's Republic of)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The Korean government has a strong policy for developing local industries for producing power plant facilities. Korea Heavy Industries and Construction Co. Ltd. (HANJUNG) is a prime contractor for the design, construction, and installation of power plant facilities. The following topics are discussed: history of the electric power in Korea, the fabrication and supply of power plants in Korea, changing factors of the power plant business around the world, HANJUNG's overseas marketing strategy, and Korea-US cooperation in third world countries.

23528 (CONF-941089–Vol.2, pp. 777-782) **Globalizing core business strategies for U.S. utilities.** Weidenbach, W.H. Jr. (Weidenbach & Associates, Inc., Atlanta, GA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

Good afternoon. I am honored to be here today and consider it a privilege to be a part of such a forum. I'd like to talk about changes that have taken place in the U.S. electric utility industry–changes that have helped promote the evolution of the independent power industry. My talk today will involve a brief history of the U.S. electric generating industry, addressing legislation and issues that affect the emerging independent power industry. Just a few years ago, electric utilities in the U.S. were experiencing very fast growth

building many new, large, state-of-the-art generating plants. Issues such as the oil embargo, regulation and public opinion made it necessary for many of these companies to move predominately to coal-fired plants while completing their nuclear programs. In additions to developing the proven, reliable and efficient operating skills for these plants, this was also a period of building strong financial posture for these companies adding to their credentials. The lower growth rate that prevails today for U.S. utilities is allowing new strength to be developed in areas such as Demand Side Management and Integrated Resource Planning. These skills have also prepared U.S. companies to expand their market opportunities. Recent regulatory changes now allow these companies to expand their core business strengths to market in the non-regulated arena both domestically and internationally. Privatization of existing facilities have offered almost instant equity an operational opportunities for these companies both at home and throughout the world. Now that major growth is in other areas-particularly in Asia, U.S. companies are quite interested in bringing their skills and capabilities to bear in these fast growing areas of opportunity. This proven experience, exceptional financial strength and entrepreneurial spirit make these companies great partnership opportunities for existing and future generating facilities.

23529 (CONF-941089–Vol.2, pp. 783-818) **Experience in independent power production: Two projects that closed.** Kappaz, M.H. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

K and M Engineering and Consulting Corporation's experience in independent power production is outlined. The following topics are discussed: the KMR Power Corporation, K and M strengths and strategy, key success factors, project experience, selected projects, and capital structure.

23530 (CONF-941089–Vol.2, pp. 819-830) **Power plant engineering for overseas market.** Chun, K.S. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

Korea's experience in power plant engineering for the overseas market is reviewed. The following topics are discussed: the Asian electric power market, ordering characteristics, country situations, and overseas market requirements.

23531 (CONF-941089–Vol.2, pp. 831-839) **A U.S. utilities perspective of foreign investments.** White, M.; Imsdahl, B. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

This paper reviews what MDU Resources Group, Inc. will use for criteria to evaluate investment opportunities in foreign countries and the strategy it has developed for foreign investments. The paper further outlines what MDU Resources Group, Inc. considers critical to make an investment in an international project.

23532 (CONF-941089–Vol.2, pp. 841-857) **Consortium formation for a coal-fired power plant in the People's Republic of China.** Kostal, K.T. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The advent of developed power projects within the People's Republic of China brings the benefits of new financing methods and the energies and resources of new participants. By necessity, it also results in fundamental changes in the many contractual relationships needed to support financial closing. The key element is the contract to design, procure, and construct the power plant. This paper compares and contrasts the requirements of these turnkey contracts with more traditional fixed price equipment supply contracts within the People's Republic of China. The emphasis of the paper is upon issues and concerns related to the successful formation of a consortium, including the effective integration of Chinese construction companies and design institutes into the process. The issues are explored from the viewpoint of the consortium's international engineer, who often participates as consortium leader and equipment procurer, in addition to detailed designer.

23533 (CONF-941089–Vol.2, pp. 967-1039) **Integrated resource planning-concepts and principles.** Atkinson, S. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

The concepts and principles of integrated resource planning (IRP) are outlined. The following topics are discussed: utility opportunities and methodologies, application considerations, ambitious energy-efficient programs, the future of IRP, three methods to study resource alternatives, the load adjustment method, simultaneous optimization, static analysis, utility profile data, load forecasts and shapes, load data, conversion, variable costs, external analysis, internal analysis, DSM objectives, supply-side prescreening, DSM screening analysis, DSM evaluation, the IRP process, risk analysis, collaborative planning process, and load shape objectives.

21 NUCLEAR POWER REACTORS AND ASSOCIATED PLANTS

Refer also to citation(s) 23206, 23614, 23626

23534 (ANL/ED/CP–85916) **Developing safer systems in a NPP environment using the operator's comfort parameters and virtual reality.** Brown-VanHoozer, S.A. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9506202–1: Symposium on human factors management and organization in NPP maintenance outages: impact on safety, Stockholm (Sweden), 19-22 Jun 1995). Order Number DE95014220. Source: OSTI; NTIS; GPO Dep.

The contents of this paper is based on two studies involving the design of visual displays from the operator's point of view, and the utilization of virtual reality for operations, training and maintenance repairs. The studies involve a methodology known as Neuro-Linguistic Programming (NLP), and its use in strengthening design choices from the user's perspective model of the environment. The contents of this paper focuses on the results which may be implemented in nuclear power plants for the purpose of providing systems which are less inherently error prone.

23535 (BNL–95012534) **BNL ALARA Center: ALARA Notes, No. 9.** Khan, T.A. (and others); Xie, J.W.; Beckman, M.C. (eds.). Brookhaven National Lab., Upton, NY (United States). Feb 1994. 62p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. Source: OSTI; NTIS; INIS; GPO.

This issue of the Brookhaven National Laboratory's Alara Notes includes the agenda for the Third International Workshop on ALARA and specific instructions on the use of the on-line fax-on-demand service provided by BNL. Other topics included in this issue are: (1) A discussion of low-level discharges from Canadian nuclear plants, (2) Safety issues at French nuclear plants, (3) Acoustic emission as a means of leak detection, (4) Replacement of steam generators at Doel-3, Beaznau, and North Anna-1, (5) Remote handling equipment at Bruce, (6) EPRI's low level waste program, (7) Radiation protection during concrete repairs at Savannah River, (8) Reactor vessel stud removal/repair at Comanche

Peak-1, (9) Rework of reactor coolant pump motors, (10) Restoration of service water at North Anna-1 and -2, (11) Steam generator tubing problems at Mihama-1, (12) Full system decontamination at Indian Point-2, (13) Chemical decontamination at Browns Ferry-2, and (14) Inspection methodolody in France and Japan.

23536 (KFK–5359) **On the estimation of the steam generator maintenance efficiency by the means of probabilistic fracture mechanics.** Cizelj, L. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung; Ljubljana Univ. (Slovenia). Oct 1994. 110p. Order Number DE95791198. Source: OSTI; NTIS (US Sales Only); INIS.

In this report, an original probabilistic model aimed to assess the efficiency of particular maintenance strategy in terms of tube failure probability is proposed. The model concentrates on axial through wall cracks in the residual stress dominated tube expansion transition zone. It is based on the recent developments in probabilistic fracture mechanics and accounts for scatter in material, geometry and crack propagation data. Special attention has been paid to model the uncertainties connected to non-destructive examination technique (e.g., measurement errors, non-detection probability). First and second order reliability methods (FORM and SORM) have been implemented to calculate the failure probabilities. This is the first time that those methods are applied to the reliability analysis of components containing stress-corrosion cracks. In order to predict the time development of the tube failure probabilities, an original linear elastic fracture mechanics based crack propagation model has been developed. It accounts for the residual and operating stresses together. Also, the model accounts for scatter in residual and operational stresses due to the random variations in tube geometry and material data. Due to the lack of reliable crack velocity vs load data, the non-destructive examination records of the crack propagation have been employed to estimate the velocities at the crack tips. (orig./GL)

23537 (NUREG–0750-Vol.41-No.4) **Nuclear Regulatory Commission issuances, April 1995. Volume 41, Number 4.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Apr 1995. 83p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This book contains issuances of the Nuclear Regulatory Commission and of the Atomic Safety and Licensing Boards, and an issuance of the Director's decision. The issuances concern a petition filed by Dr. James E Bauer seeking interlocutory Commission review of the Atomic Safety and Licensing Board's order imposing several restrictions on Dr. Bauer; a denial of an Interveners' Petition for Review addressing the application of Babcock and Wilcox for a renewal of its Special Nuclear Materials License; granting a motion for a protective order, by Sequoyah Fuel Corporation and General Atomics, limiting the use of the protected information to those individuals participating in the litigation and for the purposes of the litigation only; granting a Petitioner's petition for leave to intervene and request for a hearing concerning Georgia Institute of Technology (Georgia Tech Research Reactor) renewal of a facility license; and a denial of a petition filed by Mr. Ted Dougherty requesting a shutdown of the San Onofre Nuclear Generating Station based on concerns regarding the vulnerability of the plant to earthquakes and defensibility of the plant to a terrorist threat.

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 23618, 23625, 23627, 23630, 23631, 23633, 23847

23538 (CONF-941089–Vol.1, pp. 69-75) **Korea's choice of a new generation of nuclear plants.** Redding, J.R. (GE Nuclear Energy, San Jose, CA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

The ABWR and SBWR design, both under development at GE, provide the best platform for developing the next generation advanced plants. The ABWR, which is rapidly setting the standard for new nuclear reactor plants, is clearly the best choice to meet the present energy needs of Korea. And through a GE/Korea partnership to develop the plant of the next century, Korea will establish itself as a leader in innovative reactor technology.

23539 (CONF-941089–Vol.1, pp. 76-90) **The Advanced BWR Nuclear Plant: Safe, economic nuclear energy.** Redding, J.R. (GE Nuclear Energy, San Jose, CA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

The safety and economics of Advanced BWR Nuclear Power Plants are outlined. The topics discussed include: ABWR Programs: status in US and Japan; ABWR competitiveness: safety and economics; SBWR status; combining ABWR and SBWR: the passive ABWR; and Korean/GE partnership.

23540 (JAERI-Research–95-027) **Synthesis of complex plutonium oxides with alkaline-earth metals.** Suzuki, Yasufumi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nakajima, Kunihisa; Iwai, Takashi; Ohmichi, Toshihiko; Yamawaki, Michio. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 24p. (In Japanese). Order Number DE95789390. Source: OSTI; NTIS; INIS.

Complex plutonium(IV) oxides with strontium and barium, $SuPuO_3$ and $BaPuO_3$, were synthesized and their crystal structure was analyzed. Compacted mixture of plutonium dioxide powder and the carbonate of strontium or barium was heated in a stream of argon gas using a cell with a small orifice. The products obtained were found to be composed of a nearly single phase showing the structure of orthorhombic slightly distorted from cubic. (author).

23541 (NUREG–1432-Vol.2-Rev.1) **Standard technical specifications combustion engineering plants: Bases (Sections 2.0–3.3). Volume 2, Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Project Support. Apr 1995. 347p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report documents the results of the combined effort of the NRC and the industry to produce improved Standard Technical Specifications (STS), Revision 1 for General Electric BWR/6 Plants. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993. The improved STS will be used as the basis for individual nuclear power plant licensees to develop improved plant-specific technical specifications. This report contains three volumes.

23542 (NUREG–1527) **NRC's object-oriented simulator instructor station.** Griffin, J.I.; Griffin, J.P. Nuclear Regulatory Commission, Washington, DC (United States). Technical Training Div. Jun 1995. 105p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

As part of a comprehensive simulator upgrade program, the simulator computer systems associated with the Nuclear Regulatory Commission's (NRC) nuclear power plant simulators were replaced. Because the original instructor stations for two of the simulators were dependent on the original computer equipment, it was necessary to develop and implement new instructor stations.

This report describes the Macintosh-based Instructor Stations developed by NRC engineers for the General Electric (GE) and Babcock and Wilcox (B and W) simulators.

2102 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled

Refer also to citation(s) 23540, 23542, 23586, 23588, 23617, 23618, 23619, 23620, 23621, 23622, 23623, 23624, 23627, 23628, 23629, 23847, 24018, 24959

23543 (ANL/TD/CP–85179) **Nonproliferation and safeguards aspects of fuel cycle programs in reduction of excess separated plutonium and high-enriched uranium.** Persiani, P.J. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505227–1: 17. ERSADA symposium on safeguards and nuclear material management, Aachen (Germany), 9-11 May 1995). Order Number DE95013406. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this preliminary investigation is to explore alternatives and strategies aimed at the gradual reduction of the excess inventories of separated plutonium and high-enriched uranium (HEU) in the civilian nuclear power industry. The study attempts to establish a technical and economic basis to assist in the formation of alternative approaches consistent with nonproliferation and safeguards concerns. Reference annual mass flows and inventories for a representative 1,400 Mwe Pressurized Water Reactor (PWR) fuel cycle have been investigated for three cases: the 100 percent uranium oxide UO_2 fuel loading once through cycle, and the 33 percent mixed oxide MOX loading configuration for a first and second plutonium recycle. The analysis addresses fuel cycle developments; plutonium and uranium inventory and flow balances; nuclear fuel processing operations; UO_2 once-through and MOX first and second recycles; and the economic incentives to drawdown the excess separated plutonium stores. The preliminary analysis explores several options in reducing the excess separated plutonium arisings and HEU, and the consequences of the interacting synergistic effects between fuel cycle processes and isotopic signatures of nuclear materials on nonproliferation and safeguards policy assessments.

23544 (CONF-941089–Vol.1, pp. 41-58) **Nuclear power program and technology development in Korea.** Cho, Byung-Oke. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

KEPCO has successfully implemented the construction and operation of nuclear power plants since the early 1970s, and will continue to build safer and more efficient nuclear plants in the future in accordance with the nuclear power development plan previously established. KEPCO will also make every effort to enhance nuclear safety and obtain the public's acceptance for nuclear power. We are, however, facing the same difficulties, as United States and other countries have, in strengthened regulatory requirements, public acceptance, radwaste disposal, and acquisition of new plant sites despite an active nuclear power program. Story of Ted Turner, CNN; "It ain't as easy as it looks." Yes! It is difficult. But we will cope with these issues so that we can promote the nuclear power development and continue to supply a highly economical and clean energy to the world. In this regard, it is my sincere wish that each organization participating in the nuclear industry, especially Korea and United States strengthen their ties and help each other so that we together can successfully accomplish our goals.

23545 (CONF-941089–Vol.1, pp. 59-68) **Light water reactor program.** Franks, S.M. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's Light Water Reactor Program is outlined. The scope of the program consists of: design certification of evolutionary plants; design, development, and design certification of simplified passive plants; first-of-a-kind engineering to achieve commercial standardization; plant lifetime improvement; and advanced reactor severe accident program. These program activities of the Office of Nuclear Energy are discussed.

23546 (CONF-941089–Vol.1, pp. 91-93) **ABB Combustion Engineering nuclear technology.** Matzie, R.A. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

The activities of ABB Combustion Engineering in the design and construction of nuclear systems and components are briefly reviewed. ABB Construction Engineering continues to improve the design and design process for nuclear generating stations. Potential improvements are evaluated to meet new requirements both of the public and the regulator, so that the designs meet the highest standards worldwide. Advancements necessary to meet market needs and to ensure the highest level of performance in the future will be made.

23547 (CONF-941089–Vol.1, pp. 94-114) **ABB Combustion Engineering's nuclear experience and technologies.** Matzie, R.A. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

ABB Combustion Engineering's nuclear experience and technologies are outlined. The following topics are discussed: evolutionary approach using proven technology, substantial improvement to plant safety, utility perspective up front in developing design, integrated design, competitive plant cost, operability and maintainability, standardization, and completion of US NRC technical review.

23548 (NUREG–1430-Vol.1-Rev.1) **Standard technical specifications: Babcock and Wilcox Plants. Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Project Support. Apr 1995. 322p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report documents the results of the combined effort of the NRC and the industry to produce improved Standard Technical Specifications (STS), Revision 1 for Babcock & Wilcox Plants. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993. The improved STS will be used as the basis for individual nuclear power plant licensees to develop improved plant-specific technical specifications. This report contains three volumes. Volume 1 contains the Specifications for all chapters and sections of the improved STS. Volume 2 contains the Bases for Chapters 2.0 and 3.0, and Sections 3.1–3.3 of the improved STS. Volume 3 contains the Bases for Sections 3.4–3.9 of the improved STS.

23549 (NUREG–1431-Vol.1-Rev.1) **Standard technical specifications, Westinghouse Plants: Specifications. Volume 1, Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Apr 1995. 405p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This NUREG contains the improved Standard Technical Specifications (STS) for Westinghouse plants. Revision 1 incorporates the cumulative changes to Revision 0, which was published in September 1992. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, specifically the Westinghouse Owners Group (WOG), NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993 (58 FR 39132). Licensees are encouraged to upgrade their technical specifications consistent with those criteria and conforming, to the extent practical and consistent with the licensing basis for the facility, to Revision 1 to the improved STS. The Commission continues to place the highest priority on requests for complete conversions to the improved STS. Licensees adopting portions of the improved STS to existing technical specifications should adopt all related requirements, as applicable, to achieve a high degree of standardization and consistency.

23550 (NUREG–1431-Vol.2-Rev.1) **Standard technical specifications, Westinghouse Plants: Bases (Sections 2.0–3.3). Volume 2, Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Apr 1995. 331p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This NUREG contains the improved Standard Technical Specifications (STS) for Westinghouse plants. Revision 1 incorporates the cumulative changes to Revision 0, which was published in September 1992. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, specifically the Westinghouse Owners Group (WOG), NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993 (58 FR 39132). Licensees are encouraged to upgrade their technical specifications consistent with those criteria and conforming, to the extent practical and consistent with the licensing basis for the facility, to Revision 1 to the improved STS. The Commission continues to place the highest priority on requests for complete conversions to the improved STS. Licensees adopting portions of the improved STS to existing technical specifications should adopt all related requirements, as applicable, to achieve a high degree of standardization and consistency.

23551 (NUREG–1431-Vol.3-Rev.1) **Standard technical specifications, Westinghouse Plants: Bases (Sections 3.4–3.9). Volume 3, Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Apr 1995. 548p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This NUREG contains the improved Standard Technical Specifications (STS) for Westinghouse plants. Revision 1 incorporates the cumulative changes to Revision 0, which was published in September 1992. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, specifically the Westinghouse Owners Group (WOG), NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993 (58 FR 39132). Licensees are encouraged to upgrade their technical specifications consistent with those criteria and conforming, to the extent practical and consistent with the licensing basis for the facility, to Revision 1 to the improved STS. The Commission continues to place the highest priority on requests for complete conversions to the improved STS. Licensees adopting portions of the improved STS to existing technical specifications should adopt all related requirements, as applicable, to achieve a high degree of standardization and consistency.

2103 Power Reactors, Nonbreeding, Graphite Moderated

Refer also to citation(s) 23600

23552 (JAERI-Review–95-004) **Review of experimental studies of zirconium carbide coated fuel particles for high temperature gas-cooled reactors.** Minato, Kazuo (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Ogawa, Toru; Fukuda, Kousaku. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 31p. Order Number DE95789252. Source: OSTI; NTIS; INIS.

Experimental studies of zirconium carbide(ZrC) coated fuel particles were reviewed from the viewpoints of fuel particle designs, fabrication, characterization, fuel performance, and fission product retentiveness. ZrC is known as a refractory and chemically stable compound, so ZrC is a candidate to replace the silicon carbide(SiC) coating layer of the Triso-coated fuel particles. The irradiation experiments, the postirradiation heating tests, and the out-of-reactor experiments showed that the ZrC layer was less susceptible than the SiC layer to chemical attack by fission products and fuel kernels, and that the ZrC-coated fuel particles performed better than the standard Triso-coated fuel particles at high temperatures, especially above 1600degC. The ZrC-coated fuel particles demonstrated better cesium retention than the standard Triso-coated fuel particles though the ZrC layer showed a less effective barrier to ruthenium than the SiC layer. (author) 51 refs.

23553 (WAPD-TM–1633) **Preirradiation Data summary for the GRIT-II HTGR irradiation test specimens.** Hollenbeck, J.L. Bettis Atomic Power Lab., West Mifflin, PA (United States). May 1995. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC11-93PN38195. Order Number DE95013277. Source: OSTI; NTIS; INIS; GPO Dep.

This document comprises a report of preirradiation data on the NPR-5 and NPR-8 fuel types tested in the GRIT-II HTGR Irradiation Test in the Advanced Test Reactor. A summary of fuel characterization, GRIT-II test fabrication data, outlines of fabrication procedures, and a discussion of the GRIT technique for individual fuel bead testing is presented. Objective of the test is to provide individual irradiated HTGR fuel beads for post-irradiation valuation with total target burnups of 25, 50, and 75% fissions of initial metal atoms (FIMA).

2104 Power Reactors, Nonbreeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 23132

2105 Power Reactors, Breeding

Refer also to citation(s) 23580, 23581, 23582, 23591, 23592, 23611

23554 (ANL/FE/CP–85555) **Failed fuel identification techniques for liquid-metal cooled reactors.** Lambert, J.D.B. (Argonne National Lab., IL (United States)); Gross, K.C.; Mikaili, R.; Frank, S.M.; Cutforth, D.C.; Angelo, P.L. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950311–7: International conference on fuel management and handling, Edinburgh (United Kingdom), 20-22 Mar 1995). Order Number DE95012278. Source: OSTI; NTIS; INIS; GPO Dep.

The Experimental Breeder Reactor II (EBR-II), located in Idaho and operated for the US Department of Energy by Argonne National Laboratory, has been used as an irradiation testbed for LMR fuels and components for thirty years. During this time many endurance tests have been carried out with experimental LMR metal, oxide, carbide and nitride fuel elements, in which cladding failures were intentionally allowed to occur. This paper describes methods that have been developed for the detection, identification and verification of fuel failures.

23555 (ANL/IFR/CP–82835) **Computer imaging of EBR-II fuel handling equipment.** Peters, G.G.; Hansen, L.H. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950311–5: International conference on fuel management and handling, Edinburgh (United Kingdom), 20-22 Mar 1995). Order Number DE95012932. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a three-dimensional graphics application used to visualize the positions of remotely operated fuel handling equipment in the EBR-II reactor. A three-dimensional (3D) visualization technique is necessary to simulate direct visual observation of the transfers of fuel and experiments into and out of the reactor because the fuel handling equipment is submerged in liquid sodium and therefore is not visible to the operator. The system described in this paper uses actual signals to drive a three-dimensional computer-generated model in real-time in response to movements of equipment in the plant This paper will present details on how the 3D model of the intank equipment was created and how real-time dynamic behavior was added to each of the moving components.

23556 (ANL/IFR/CP–82925) **Visual imagery and the user model applied to fuel handling at EBR-II.** Brown-VanHoozer, S.A. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950311–6: International conference on fuel management and handling, Edinburgh (United Kingdom), 20-22 Mar 1995). Order Number DE95012931. Source: OSTI; NTIS; INIS; GPO Dep.

The material presented in this paper is based on two studies involving visual display designs and the user's perspective model of a system. The studies involved a methodology known as Neuro-Linguistic Programming (NLP), and its use in expanding design choices which included the "comfort parameters" and "perspective reality" of the user's model of the world. In developing visual displays for the EBR-II fuel handling system, the focus would be to incorporate the comfort parameters that overlap from each of the representation systems: visual, auditory and kinesthetic then incorporate the comfort parameters of the most prominent group of the population, and last, blend in the other two representational system comfort parameters. The focus of this informal study was to use the techniques of meta-modeling and synesthesia to develop a virtual environment that closely resembled the operator's perspective of the fuel handling system of Argonne's Experimental Breeder Reactor - II. An informal study was conducted using NLP as the behavioral model in a v reality (VR) setting.

23557 (UTNL-R–0313) **Report of workshop on heat transfer and fluid flow in Fast Breeder Reactor (FBR), Yayoi Research Group.** Tokyo Univ., Tokai, Ibaraki (Japan). Nuclear Engineering Research Lab. Jul 1994. 120p. (In Japanese). Order Number DE95789431. Source: OSTI; NTIS; INIS.

This issue is the collection of the papers presented on heat transfer and fluid flow of FBR type reactors. The 4 of the presented papers are indexed individually. (J.P.N.).

2106 Power Reactors, Mobile, Propulsion, Package, and Transportable

23558 (DOE/SF/18852–T53) **Monthly technical progress report, May 29, 1995–July 2, 1995.** Waks, J.M. Martin Marietta Astro Space, King of Prussia, PA (United States). 24 Jul 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-91SF18852. Order Number DE95015363. Source: OSTI; NTIS; INIS; GPO Dep.

The technical progress achieved during the period 29 May through 2 July 1995 on Contract DE-AC03-91SF18852 Radioisotope Thermoelectric Generators and Ancillary Activities is described herein.

23559 (LA-UR–95-1383) **Heatpipe space power and propulsion systems.** Houts, M.G.; Poston, D.I.; Ranken, W.A. Los Alamos National Lab., NM (United States). [1995]. 8p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950729–10: 30. Intersociety energy conversion conference, Orlando, FL (United States), 30 Jul - 5 aug 1995). Order Number DE95014013. Source: OSTI; NTIS; GPO Dep.

Safe, reliable, low-mass space power and propulsion systems could have numerous civilian and military applications. This paper discusses two fission-powered concepts: the Heatpipe Power System (HPS) that provides power only, and the Heatpipe Bimodal System (HBS) that provides both power and thermal propulsion. Both concepts have 10 important features. First, only existing technology and recently tested fuel forms are used. Second, fuel can be removed whenever desired, greatly facilitating system fabrication and handling. Third, full electrically heated system testing is possible, with minimal operations required to replace the heaters with fuel and ready the system for launch. Fourth, the systems are passively subcritical during launch accidents. Fifth, a modular approach is used, and most technical issues can be resolved with inexpensive module tests. Sixth, bonds between dissimilar metals are minimized. Seventh, there are no single point failures during power mode operation. Eighth, fuel burnup rate is quite low to help ensure greater than 10-year system life. Ninth, there are no pumped coolant loops, and the systems can be shut down and restarted without coolant freeze/thaw concerns. Finally, a full ground nuclear test is not needed, and development costs will be low. The baseline HPS uses SNAP-10A-style thermoelectric power converters to produce 5 kWe at a system mass of about 500 kg. The unicouple thermoelectric converters have a hot shoe temperature of 1275 K and reject waste heat at 775 K. This type of thermoelectric converter has been used extensively by the space program, demonstrating an operational lifetime of decades. At higher thermal power, the same core can produce over 10 kWe using thermoelectric converters, and over 50 kWe using advanced power conversion systems.

2107 Regulation and Licensing

Refer also to citation(s) 23549, 23550, 23551, 23722

23560 (NUREG–0750-Vol.41-Index-1) **Indexes to Nuclear Regulatory Commission issuances, January–March 1995. Volume 41, Index 1.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Jun 1995. 34p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

Digests and indexes for issuances of the Commission (CLI), the Atomic Safety and Licensing Board Panel (LBP), the Administrative Law Judges (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM) are presented in this document. These digests and indexes are intended to serve as a guide to the issuances. Information elements common to the cases heard and ruled upon are: case name (owner(s) of facility); full text reference (volume and pagination); issuance number; issues raised by appellants; legal citations (cases, regulations, and statutes); name of facility, docket number; subject matter of issues and/or rulings; type of hearing (for construction permit, operating license, etc.); and type of issuance (memorandum, order, decision, etc.).

23561 (NUREG–0750-Vol.41-No.3) **Nuclear Regulatory Commission issuances, March 1995. Volume 41, No. 3.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. 1995. 70p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judges (ALJ), the Directors' Decisions (DD), and the Decisions on Petitions for Rulemaking (DPRM).

23562 (NUREG–0940-Vol.14-No.1-Pt.1) **Enforcement actions: Significant actions resolved. Reactor licensees: Volume 14, No. 1, Part 1, Quarterly progress report January–March 1995.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Enforcement. [1995]. 352p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (January–March 1995) and includes copies of letters, Notices, and Orders sent by the Nuclear Regulatory Commission to reactor licensees with respect to these enforcement actions. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, so that actions can be taken to improve safety by avoiding future violations similar to those described in this publication.

23563 (NUREG–1478-Rev.1) **Non-Power Reactor Operator Licensing Examiner Standards. Revision 1.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Reactor Controls and Human Factors. Jun 1995. 170p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

The Non-Power Reactor Operator Licensing Examiner Standards provide policy and guidance to NRC examiners and establish the procedures and practices for examining and licensing of applicants for NRC operator licenses pursuant to Part 55 of Title 10 of the Code of Federal Regulations (10 CFR 55). They are intended to assist NRC examiners and facility licensees to understand the examination process better and to provide for equitable and consistent administration of examinations to all applicants by NRC examiners. These standards are not a substitute for the operator licensing regulations and are subject to revision or other internal operator examination licensing policy changes. As appropriate, these standards will be revised periodically to accommodate comments and reflect new information or experience.

2108 Economics

Refer also to citation(s) 23543, 23630, 23631, 23633, 23701, 23722

22 NUCLEAR REACTOR TECHNOLOGY

Refer also to citation(s) 24205

2201 Theory and Calculation

Refer also to citation(s) 23580, 23595, 23599

23564 (ANL/RA/CP–86533) **Pitfalls in criticality safety Monte Carlo computations: The keff of the world.** Gelbard, E.M. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505195–8: Nuclear criticality technology and safety project (NCTSP) annual meeting, San Diego, CA (United States), 17 May 1995). Order Number DE95013789. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. CRITICALITY/monte carlo method; SAFETY; EIGENVALUES; CRITICALITY; PLUTONIUM; ERRORS

2202 Components and Accessories

Refer also to citation(s) 23535, 23558, 23559, 23583, 23584, 23587, 23613, 23632, 23634, 23635

23565 (ANL/ET/CP–84157) **Pressure transient in liquid lines.** Sun, J.G. (Argonne National Lab., IL (United States)); Wang, X.Q. Argonne National Lab., IL (United States). [1995]. 14p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950740–65: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Source: OSTI; NTIS; INIS.

The pressure surge that results from a step change of flow in liquid pipelines, commonly known as water hammer, was analyzed by an eigenfunction method. A differential-integral Pressure wave equation and a linearized velocity equation were derived from the equations of mass and momentum conservation. Waveform distortion due to viscous dissipation and pipe-wall elastic expansion is characterized by a dimensionless transmission number K. The pressure surge condition, which is mathematically singular, was used in the solution procedure. The exact solutions from numerical calculation of the differential-integral equation provide a complete Pressure transient in the pipe. The problems are also calculated With the general-purpose computer code COMMIX, which solves the exact mass conservation equation and Navier-Stokes equations. These solutions were compared with published experimental results, and agreement was good. The effect of turbulence on the pressure transient is discussed in the light of COMMIX calculational results.

23566 (ANL/RE/CP–85732) **PRODIAG – Dynamic qualitative analysis for process fault diagnosis.** Reifman, J.; Wei, T.Y.C. Argonne National Lab., IL (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950564–5: 9. symposium on power plant dynamics, control and testing, Knoxville, TN (United States), 24-26 May 1995). Order Number DE95013403. Source: OSTI; NTIS; INIS; GPO Dep.

The authors present a method for handling the dynamic effects of process component malfunctions through time-independent rule-based diagnostic systems. The method's theory is discussed and a simplified version is implemented in the process diagnostic expert system PRODIAG. Simulation results from a full-scope operator training simulator of a nuclear power plant are used to illustrate the method.

23567 (BNL-NUREG–61789) **Plant maintenance and aging management: Are they the same?.** Lofaro, R.J. Brookhaven National Lab., Upton, NY (United States). [1995]. 10p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950740–51: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Source: OSTI; NTIS; INIS.

As part of the NRC's Nuclear Plant Aging Research Program, a number of aging studies were performed on safety-related systems and components which found that, even with current maintenance and monitoring practices in place, a large number of the reported failures are related to aging. This suggests that current practices are not sufficient to completely manage aging degradation, and other factors need to be considered. This paper examines the aging management process and the degree to which maintenance plays a part in it. Component failures and degradation mechanisms identified in aging studies of several different safety systems are summarized and evaluated, then con-elated with the components most frequently failed. This information, along with an analysis of failure causes, is then used to determine the extent to which aging is managed by current maintenance practices. Conclusions and recommendations for proper aging management arc also presented.

23568 (CONF-941089–Vol.1, pp. 115-137) **Optimization of life cycle management costs.** Banerjee, A.K. (Stone & Webster Engineering Corp., Boston, MA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1*. 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

As can be seen from the case studies, a LCM program needs to address and integrate, in the decision process, technical, political, licensing, remaining plant life, component replacement cycles, and financial issues. As part of the LCM evaluations, existing plant

programs, ongoing replacement projects, short and long-term operation and maintenance issues, and life extension strategies must be considered. The development of the LCM evaluations and the cost benefit analysis identifies critical technical and life cycle cost parameters. These "discoveries" result from the detailed and effective use of a consistent, quantifiable, and well documented methodology. The systematic development and implementation of a plant-wide LCM program provides for an integrated and structured process that leads to the most practical and effective recommendations. Through the implementation of these recommendations and cost effective decisions, the overall power production costs can be controlled and ultimately lowered.

23569 (CONF-941089–Vol.1, pp. 139-204) **Advanced maintenance, inspection & repair technology for nuclear power plants.** Hinton, B.M. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Maintenance, inspection, and repair technology for nuclear power plants is outlined. The following topics are discussed: technology for reactor systems, reactor refueling bridge, fuel inspection system, fuel shuffling software, fuel reconstitution, CEA/RCCA/CRA inspection, vessel inspection capabilities, CRDM inspection and repair, reactor internals inspection and repair, stud tensioning system, stud/nut cleaning system, EDM machining technology, MI Cable systems, core exit T/C nozzle assemblies, technology for steam generators, genesis manipulator systems, ECT, UT penetrant inspections, steam generator repair and cleaning systems, technology for balance of plant, heat exchangers, piping and weld inspections, and turbogenerators.

23570 (CONF-941089–Vol.1, pp. 205-225) **Improved technical specifications.** Hoffman, D.R. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Improved technical specifications for nuclear power plants are outlined. The objectives of this work are to improve safety, provide a clearer understanding of safety significance, and ease NRC and industry administrative burdens. Line item improvements, bases, and implementation of the specifications are discussed.

23571 (CONF-941089–Vol.1, pp. 227-240) **ENIDINE: Vibration and seismic isolation technologies for power generation station applications.** Zemanek, T.A. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

ENIDINE Inc. is a world leader in the design and manufacture of shock and vibration mounts. Founded in 1966, the company has two manufacturing facilities, employs over 300 people and supports a worldwide network of distributors and representatives. ENIDINE Inc. is part of the ENIDINE Corporate Group which owns a number of companies that design and manufacture Hydraulic/Pneumatic cylinders, Electromechanical devices, Hydraulic Control Valves and a number of Industrial Distribution companies throughout Europe. In total, the ENIDINE Corporate Group has over 900 employees with annual sales of over $100 million. ENIDINE shock and vibration mounts are used to isolate the vibration of missiles from their guidance systems, pumps from hospital operating equipment and off shore oil rigs, from the shock energy of waves in the North Sea. ENIDINE products can be found on all Boeing and McDonnell Douglas aircraft, as well as many electronic and weapons systems on board Navy ships.

23572 (CONF-941089–Vol.1, pp. 241-254) **A versatile electrical penetration design qualified to IEEE Std. 317-1983.** Lankenau, W. (Imaging & Sensing Technology Corp., Horseheads, NY (United States)); Wetherill, T.M. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Although worldwide demand for new construction of nuclear power stations has been on a decline, the available opportunities for the design and construction of qualified electrical penetrations continues to offer challenges, requiring a highly versatile design. Versatility is necessary in order to meet unique customer requirements within the constraints of a design basis qualified to IEEE Std. 317-1983. This paper summarizes such a versatile electrical penetration designed, built and tested to IEEE Std. 317-1983. The principal features are described including major materials of construction. Some of the design constraints such as sealing requirements, and conductor density (including numerical example) are discussed. The requirements for qualification testing of the penetration assembly to IEEE Std. 317-1983 are delineated in a general sense, and some typical test ranges for preconditioning, radiation exposure, and LOCA are provided. The paper concludes by describing ways in which this versatile design has been adapted to meet unique customer requirements in a variety of nuclear power plants.

23573 (CONF-941089–Vol.1, pp. 255-264) **Testing and plugging power plant heat exchangers.** Sutor, F. (Expando Seal Tools, Inc., Montgomeryville, PA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Heat Exchanger tubes fail for any number of reasons including but certainly not limited to the cumulative effects of corrosion, erosion, thermal stress and fatigue. This presentation will attempt to identify the most common techniques for determining which tubes are leaking and then introduce the products in use to plug the leaking tubes. For the sake of time I will limit the scope of this presentation to include feedwater heaters and secondary system heat exchangers such as Hydrogen Coolers, Lube Oil Coolers, and nuclear Component Cooling Water, Emergency Cooling Water, Regenerative Heat Recovery heat exchangers.

23574 (CONF-9507130–1) **Stress-intensity-factor influence coefficients for semielliptical inner-surface flaws in clad pressure vessels.** Keeney, J.A.; Bryson, J.W. Oak Ridge National Lab., TN (United States). [1995]. 15p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. Interagency Agreement 1886-8011-9B. From 26. national symposium on fracture mechanics; Idaho Falls, ID (United States); 27 Jul 1995. Order Number DE95013207. Source: OSTI; NTIS; INIS; GPO Dep.

A problem of particular interest in pressure vessel technology is the calculation of accurate stress-intensity factors for semielliptical surface cracks in cylinders. Computing costs for direct solution techniques can be prohibitive when applied to three-dimensional (3-D) geometries with time-varying boundary conditions such as those associated with pressurized thermal shock. An alternative superposition technique requires the calculation of a set of influence coefficients for a given 3-D crack model that can be superimposed to obtain mode-I stress-intensity factors. This paper presents stress-intensity-factor influence coefficients (SIFICs) for axially and circumferentially oriented finite-length semielliptical inner-surface flaws with aspect ratios [total crack length (2c) to crack depth (a)] of 2, 6, and 10 for clad cylinders having an internal radius (R_i) to wall thickness (t) ratio of 10. SEFICs are computed for flaw depths in the range of $0.01 \leq a/t \leq 0.5$ and two cladding thicknesses. The incorporation of this SEFIC data base in fracture mechanics codes will facilitate the generation of fracture mechanics solutions for a wide range of flaw geometries as may be required in structural

integrity assessments of pressurized-water and boiling-water reactors.

23575 (NUREG/CR–4639-Vol.5-Rev.4) **Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): Data manual, Part 2: Human Error Probability (HEP) Data. Volume 5, Revision 4.** Reece, W.J. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Gilbert, B.G.; Richards, R.E. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1994. 449p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (EGG–2458-Vol.5-Rev.4). Source: OSTI; NTIS; GPO; INIS.

This data manual contains a hard copy of the information in the Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) Version 3.5 database, which is sponsored by the US Nuclear Regulatory Commission. NUCLARR was designed as a tool for risk analysis. Many of the nuclear reactors in the US and several outside the US are represented in the NUCLARR database. NUCLARR includes both human error probability estimates for workers at the plants and hardware failure data for nuclear reactor equipment. Aggregations of these data yield valuable reliability estimates for probabilistic risk assessments and human reliability analyses. The data manual is organized to permit manual searches of the information if the computerized version is not available. Originally, the manual was published in three parts. In this revision the introductory material located in the original Part 1 has been incorporated into the text of Parts 2 and 3. The user can now find introductory material either in the original Part 1, or in Parts 2 and 3 as revised. Part 2 contains the human error probability data, and Part 3, the hardware component reliability data.

23576 **Vortex diode jet.** Houck, E.D. To Dept. of Energy. 1993. Filed date 27 May 1993. U.S. Patent Application 8-067,914. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE95015042. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A fluid transfer system that combines a vortex diode with a jet ejector to transfer liquid from one tank to a second tank by a gas pressurization method having no moving mechanical parts in the fluid system. The vortex diode is a device that has a high resistance to flow in one direction and a low resistance to flow in the other.

2203 Fuel Elements

Refer also to citation(s) 23153, 23598

23577 (ANL/RA/CP–82800) **Automatic inspection for remotely manufactured fuel elements.** Reifman, J. (Argonne National Lab., IL (United States)); Vitela, J.E.; Gibbs, K.S.; Benedict, R.W. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950232–34: 6. American Nuclear Society meeting on robotics and remote systems, Monterey, CA (United States), 5-10 Feb 1995). Order Number DE95012289. Source: OSTI; NTIS; INIS; GPO Dep.

Two classification techniques, standard control charts and artificial neural networks, are studied as a means for automating the visual inspection of the welding of end plugs onto the top of remotely manufactured reprocessed nuclear fuel element jackets. Classificatory data are obtained through measurements performed on pre- and post-weld images captured with a remote camera and processed by an off-the-shelf vision system. The two classification methods are applied in the classification of 167 dummy stainless steel (HT9) fuel jackets yielding comparable results.

23578 (FZKA–5582) **Measurements of turbulent velocity and temperature in a wall channel of a heated rod bundle.** Krauss, T.; Meyer, L. Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Inst. fuer Neutronenphysik und Reaktortechnik. May 1995. 110p. Order Number DE95790240. Source: OSTI; NTIS (US Sales Only); INIS.

Turbulent air flow in a wall sub-channel of a heated 37-rod bundle (P/D=1.12, W/D=1.06) was investigated. Measurements were performed with a hot-wire probe with x-wires and a temperature wire. The mean velocity, the mean fluid temperature, the wall shear stress and wall temperature, the turbulent quantities such as the turbulent kinetic energy, the Reynolds-stresses and the turbulent heat fluxes were measured and are discussed with respect to data from isothermal flow in a wall channel and heated flow in a central channel of the same rod bundle. Also, data on the power spectral densities of the velocity and temperature fluctuations are presented. These data show the existence of large scale periodic fluctuations of velocity and temperature in the gap region of two adjacent rods or between rods and the wall. These fluctuations are responsible for the high intersubchannel heat and momentum exchange. (orig.)

23579 (JAERI-Research–95-008) **Post irradiation examinations of uranium-plutonium mixed nitride fuel irradiated in JMTR (88F-5A capsule).** Arai, Yasuo (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Iwai, Takashi; Sasayama, Tatsuo; Okamoto, Yoshihiro; Nakajima, Kunihisa; Sukegawa, Tomohide; Yamahara, Takeshi; Suzuki, Yasufumi; Niimi, Motoji. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 100p. (In Japanese). Order Number DE95789260. Source: OSTI; NTIS; INIS.

Two helium-bonded fuel pins filled with uranium-plutonium mixed nitride pellets were encapsulated in 88F-5A and irradiated in JMTR up to 4.1%FIMA at a maximum linear power of 65 kW/m. The capsule cooled for ≈4 months was transported to Reactor Fuel Examination Facility and subjected to non-destructive and destructive post irradiation examinations. Any failure was not observed in the irradiated fuel pins. It was found from the temperature change at pellet center that the helium gap between the pellets and the cladding tube was gradually closed during irradiation. Very low fission gas release rate of about 2-3% was observed, while the diametric increase of fuel pin was limited to ≈0.4% at the position of maximum reading. The inner surface of cladding tube did not show the signs of chemical interaction with fuel. In addition, some information on restructuring of fuel pellets was obtained. (author).

2204 Control Systems

Refer also to citation(s) 23514, 23636

23580 (ANL/ED/CP–84176) **Mu-synthesis control of the EBR-II primary reactor system.** Power, M.A. (Pennsylvania State Univ., University Park, PA (United States). Nuclear Engineering Dept.); Edwards, R.M.; Dean, E. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950564–3: 9. symposium on power plant dynamics, control and testing, Knoxville, TN (United States), 24-26 May 1995). Order Number DE95013419. Source: OSTI; NTIS; INIS; GPO Dep.

A robust μ-synthesis controller for the EBR-II reactor primary system and the DSNP simulations verifying the excellent robustness of the controller over a wide range of power are presented.

23581 (ANL/IFR/CP–83964) **EBR-II secondary sodium loop Plugging Temperature Indicator control system upgrade.** Carlson, R.B.; Gehrman, R.L. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950564–2: 9. symposium on power plant dynamics, control and testing, Knoxville, TN (United States), 24-26 May 1995). Order Number DE95013471. Source: OSTI; NTIS; INIS; GPO Dep.

The Experimental Breeder Reactor II (EBR-II) secondary sodium coolant loop Plugging Temperature Indicator (PTI) control system was upgraded in 1993 to a real-time computer based system. This was done to improve control, to remove obsolete and high maintenance equipment, and to provide a graphical CRT based operator interface. A goal was to accomplish this inexpensively using small, reliable computer and display hardware with a minimum of purchased software. This paper describes the PTI system, the upgraded control system and its operator interface, and development methods and tools. The paper then assesses how well the system met its goals, discusses lessons learned and operational improvements noted, and provides some recommendations and suggestions on applying small real-time control systems of this type.

23582 (ANL/IFR/SUMM–85396) **Simplified modeling of the EBR-II control rods.** Angelo, P.L. Argonne National Lab., Idaho Falls, ID (United States). 25 Jun 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950601–14: Annual meeting of the American Nuclear Society (ANS), Philadelphia, PA (United States), 25-29 Jun 1995). Order Number DE95014234. Source: OSTI; NTIS; INIS; GPO Dep.

Simplified models of EBR-II control and safety rods have been developed for core modeling under various operational and shutdown conditions. A parametric study was performed on normal worth, high worth, and safety rod type control rods. A summary of worth changes due to individual modeling approximations is tabulated. Worth effects due to structural modeling simplification are negligible. Fuel region homogenization and burnup compression contributes more than any other factor. Reference case C/E values (ratio of calculated worth from detailed model to measured worth) of 1.072 and 1.142 for safety and normal worth rods indicate acceptable errors when the approximations are used. Fuel burnup effect illustrates rod worth sensitivity to the modeling approximation. Aggregate effects are calculated under a reduced mesh.

23583 (BNL-NUREG–61712) **Methodological issues in the validation of complex human-machine systems.** O'Hara, J. (Brookhaven National Lab., Upton, NY (United States)); Stubler, W.; Wachtel, J. Brookhaven National Lab., Upton, NY (United States). [1995]. 6p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9506175–3: Computer-based human support systems: technology, methods and future, Philadelphia, PA (United States), 25-29 Jun 1995). Order Number DE95011778. Source: OSTI; NTIS; GPO Dep.

Integrated system validation is one aspect of the US Nuclear Regulatory Commission's design review process for human-system interfaces. This paper will consider three methodological issues that must be addressed in validation and their implications for drawing conclusions about the acceptability of the integrated system. They are: representing the integrated system, representing the operational events it must handle, and representing system performance. A logical basis for generalizability from validation tests to predicted performance of the integrated system emerges from the comparability of the psychological and physical processes of the test and actual situations. Generalizability of results is supported when the integrated system, operating conditions and performance are representative of their real-world counterparts. The methodological considerations for establishing representativeness are discussed.

23584 (BNL-NUREG–61715) **Advanced alarm systems: Display and processing issues.** O'Hara, J.M. (Brookhaven National Lab., Upton, NY (United States)); Wachtel, J.; Perensky, J. Brookhaven National Lab., Upton, NY (United States). [1995]. 8p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9506175–2: Computer-based human support systems: technology, methods and future, Philadelphia, PA (United States), 25-29 Jun 1995). Order Number DE95011779. Source: OSTI; NTIS; GPO Dep.

This paper describes a research program sponsored by the US Nuclear Regulatory Commission to address the human factors engineering (HFE) deficiencies associated with nuclear power plant alarm systems. The overall objective of the study is to develop HFE review guidance for alarm systems. In support of this objective, human performance issues needing additional research were identified. Among the important issues were alarm processing strategies and alarm display techniques. This paper will discuss these issues and briefly describe our current research plan to address them.

23585 (Juel–2928) **Development of advanced methods and related software for human reliability evaluation within probabilistic safety analyses.** Kosmowski, K.T. (Gdansk Univ. (Poland)); Mertens, J.; Degen, G.; Reer, B. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Sicherheitsforschung und Reaktortechnik. Jun 1994. 184p. Order Number DE95791275. Source: OSTI; NTIS (US Sales Only); INIS.

Human Reliability Analysis (HRA) is an important part of Probabilistic Safety Analysis (PSA). The first part of this report consists of an overview of types of human behaviour and human error including the effect of significant performance shaping factors on human reliability. Particularly with regard to safety assessments for nuclear power plants a lot of HRA methods have been developed. The most important of these methods are presented and discussed in the report, together with techniques for incorporating HRA into PSA and with models of operator cognitive behaviour. Based on existing HRA methods the concept of a software system is described. For the development of this system the utilization of modern programming tools is proposed; the essential goal is the effective application of HRA methods. A possible integration of computeraided HRA within PSA is discussed. The features of Expert System Technology and examples of applications (PSA, HRA) are presented in four appendices. (orig.)

2205 Environmental Aspects

Refer also to citation(s) 23701

23586 (BNL–61458) **Effect of groundwater on soil-structure interaction.** Xu, J. (Brookhaven National Lab., Upton, NY (United States)); Bandyopadhyay, K.K.; Kassir, M.K. Brookhaven National Lab., Upton, NY (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950740–69: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95014518. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents results of a parametric study performed to investigate the effect of pore water in saturated soils on the response of nuclear containment structures to seismic motions. The technique employed uses frequency domain algorithm which incorporates impedances for both dry and saturated soils into an SSI model. A frequency domain time history analysis is carried out using the computer code CARES for a typical PWR containment structure. Structural responses presented in terms of floor response spectra indicate that considering the presence of the pore water in soils could benefit the design of massive nuclear containment structures.

23587 (NUREG/CP–0141) **Proceedings of the 23rd DOE/NRC nuclear air cleaning conference.** First, M.W. (ed.) (Harvard Univ., Boston, MA (United States). Harvard Air Cleaning Lab.). US-DOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance; Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; International Society of Nuclear Air Treatment Technologies, Inc., Batavia, OH (United States); Harvard Univ., Boston, MA (United States). Harvard Air Cleaning Lab. Feb 1995. 820p. Sponsored by USDOE, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract FG01-94EH89439. (CONF-940738–: 23. DOE/NRC nuclear air cleaning and treatment conference, Buffalo, NY (United States), 25-28 Jul 1994). Source: OSTI; NTIS; GPO; INIS.

The report contains the papers presented at the 23rd DOE/NRC Nuclear Air Cleaning Conference and the associated discussions. Major topics are: (1) nuclear air cleaning codes, (2) nuclear waste, (3) filters and filtration, (4) effluent stack monitoring, (5) gas processing, (6) adsorption, (7) air treatment systems, (8) source terms and accident analysis, and (9) fuel reprocessing.

23588 (NUREG/CR–6144-Vol.6-Pt.1) **Evaluation of potential severe accidents during low power and shutdown operations at Surry, Unit 1: Evaluation of severe accident risk during mid-loop operations. Main report. Volume 6. Part 1.** Jo, J. (Brookhaven National Lab., Upton, NY (United States)); Lin, C.C.; Neymotin, L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Technology; Brookhaven National Lab., Upton, NY (United States). May 1995. 142p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52399-Vol.6-Pt.1). Source: OSTI; NTIS; GPO; INIS.

During 1989, the Nuclear Regulatory Commission (NRC) initiated an extensive program to carefully examine the potential risks during low power and shutdown operations. The program includes two

parallel projects being performed by Brookhaven National Laboratory (BNL) and Sandia National Laboratories (SNL). Two plants, Surry (pressurized water reactor) and Grand Gulf (boiling water reactor), were selected as the plants to be studied. The objectives of the program are to assess the risks of severe accidents initiated during plant operational states other than full power operation and to compare the estimated core damage frequencies, important accident sequences and other qualitative and quantitative results with those accidents initiated during full power operation as assessed in NUREG-1150. The scope of the program includes that of a level-3 PRA. A phased approach was used in the level-1 program. In phase 1 which was completed in Fall 1991, a coarse screening analysis including internal fire and flood was performed for all plant operational states (POSs). The objective of the phase 1 study was to identify potential vulnerable plant configurations, to characterize (on a high, medium, or low basis) the potential core damage accident scenarios, and to provide a foundation for a detailed phase 2 analysis. In phase 2, mid-loop operation was selected as the plant configuration to be analyzed based on the results of the phase 1 study. The objective of the phase 2 study is to perform a detailed analysis of the potential accident scenarios that may occur during mid-loop operation, and compare the results with those of NUREG-1150. The results of the phase 2 level 2/3 study are the subject of this volume of NUREG/CR-6144, Volume 6.

23589 (WHC-SD-FF-QAPP–005-Rev.1) **Quality Assurance Program Plan for FFTF effluent controls. Revision 1.** Seamans, J.A. Westinghouse Hanford Co., Richland, WA (United States). 8 Jun 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014312. Source: OSTI; NTIS; INIS; GPO Dep.

This Quality Assurance Program Plan is specific to environmental related activities within the FFTF Property Protected Area. The activities include effluent monitoring and Low Level Waste Certification.

23590 (WSRC-TR–95-0219) **Assessment of Noble Gases in the Savannah River Site Environment.** Carlton, W.H.; Murphy, C.E. Jr. Westinghouse Savannah River Co., Aiken, SC (United States). Apr 1995. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95060153. Source: OSTI; NTIS; GPO Dep.

A series of documents has been published that assesses the impact of various radionuclides released to the environment by Savannah River Site operations. The quantity released, the disposition of the radionuclides in the environment, and the dose to offsite individuals has been presented for carbon, cesium, iodine, plutonium, strontium, technetium, tritium, and uranium. An assessment of the impact of non-radioactive mercury also has been published.

2206 Research, Test, Training, Production, Irradiation, Materials Testing Reactors

Refer also to citation(s) 23131, 23385, 23408, 23534, 23537, 23563, 23582, 23589, 23611, 23614, 23828, 23975

23591 (ANL/IFR/CP–84087) **EBR-II argon cooling system restricted fuel handling I and C upgrade.** Start, S.E. (Argonne National Lab., Idaho Falls, ID (United States). Engineering Div.); Carlson, R.B.; Gehrman, R.L. Argonne National Lab., IL (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950564–7: 9. symposium on power plant dynamics, control and testing, Knoxville, TN (United States), 24-26 May 1995). Order Number DE95013402. Source: OSTI; NTIS; INIS; GPO Dep.

The instrumentation and control of the Argon Cooling System (ACS) restricted fuel handling control system at Experimental Breeder Reactor II (EBR-II) is being upgraded from a system comprised of many discrete components and controllers to a computerized system with a graphical user interface (GUI). This paper describes the aspects of the upgrade including reasons for the upgrade, the old control system, upgrade goals, design decisions, philosophies and rationale, and the new control system hardware and software.

23592 (ANL/IFR/CP–84088) **EBR-II fuel handling console digital upgrade.** Peters, G.G. (Argonne National Lab., Idaho Falls, ID (United States). Integral Fast Reactor Operations Div.); Wiege, D.D.; Christensen, L.J. Argonne National Lab., IL (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950564–6: 9. symposium on power plant dynamics, control and testing, Knoxville, TN (United States), 24-26 May 1995). Order Number DE95013401. Source: OSTI; NTIS; INIS; GPO Dep.

The main fuel handling console and control system at the Experimental Breeder Reactor II (EBR-II) are being upgraded to a computerized system using high-end workstations for the operator interface and a programmable logic controller (PLC) for the control system. Two-dimensional (2D) and three-dimensional (3D) computer graphics will be provided for the operator which will show the relative position of under-sodium fuel handling equipment. This equipment is operated remotely with no means of directly viewing the transfer. This paper describes various aspects of the modification including reasons for the upgrade, capabilities the new system provides over the old control system, philosophies and rationale behind the new design, testing and simulation work, diagnostic features, and the advanced graphics techniques used to display information to the operator.

23593 (CONF-950740–49) **Prevention of non-ductile fracture in 6061-T6 aluminum nuclear pressure vessels.** Yahr, G.T. (Oak Ridge National Lab., TN (United States). Engineering Technology Div.). Oak Ridge National Lab., TN (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessels and piping conference; Honolulu, HI (United States); 23-27 Jul 1995. Order Number DE95013043. Source: OSTI; NTIS; INIS; GPO Dep.

The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Committee has approved rules for the use of 6061-T6 and 6061-T651 aluminum for the construction of Class 1 welded nuclear pressure vessels for temperatures not exceeding 149 C (300 F). Nuclear Code Case N-519 allows the use of this aluminum in the construction of low temperature research reactors such as the Advanced Neutron Source. The rules for protection against non-ductile fracture are discussed. The basis for a value of 25.3 MPa $\sqrt{m}$ (23 ksi $\sqrt{in.}$) for the critical or reference stress intensity factor for use in the fracture analysis is presented. Requirements for consideration of the effects of neutron irradiation on the fracture toughness are discussed.

23594 (CONF-9509100–2) **A small graphite-reflected UO_2 assembly.** Mihalczo, J.T. Oak Ridge National Lab., TN (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. international conference on nuclear criticality safety; Albuquerque, NM (United States); 17-22 Sep 1995. Order Number DE95014600. Source: OSTI; NTIS; INIS; GPO Dep.

An unmoderated, graphite-reflected, critical assembly of UO_2, enriched to 93.15 wt % in ^{235}U, is described. The UO_2 pellets (density, 9.71 g/cm^3) were contained in 253 1.27-cm-diam stainless steel tubes, which, in turn, are close packed in an aluminum container 22.87 cm in diameter and 31.11 cm long. This mockup of a small, potassium-cooled space power reactor, which was under study at Oak Ridge National Laboratory in 1963, provided data for validation of reactor physics methods. Two combinations of top and side reflectors were found to make the assembly critical. In one configuration, the thickness of the top and the side reflectors was 12.70 and 19.25 cm respectively; in the other, these dimensions were 5.08 and 24.34 cm. Fission distribution measurements axially through the assembly with the thicker radial reflector and radially through the reflector showed a peak in the reflector 3.5 greater than at the center of the core. The ^{235}U cadmium ratio measured in the side reflector at the core midplane for the assembly with the 19.25-cm-thick side reflector varied from 1.77 near the core boundary to 2.43 beyond 10 cm into the side reflector.

23595 (DOE/ER/75884–T1) **Nuclear safety analyses and core design calculations to convert the Texas A & M University Nuclear Science Center reactor to low enrichment uranium fuel. Final report.** Parish, T.A. Texas A and M Univ.,

College Station, TX (United States). Texas Engineering Experiment Station. 2 Mar 1995. 228p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-93ER75884. Order Number DE95015453. Source: OSTI; NTIS; GPO Dep.

This project involved performing the nuclear design and safety analyses needed to modify the license issued by the Nuclear Regulatory Commission to allow operation of the Texas A& M University Nuclear Science Center Reactor (NSCR) with a core containing low enrichment uranium (LEU) fuel. The specific type of LEU fuel to be considered was the TRIGA 20-20 fuel produced by General Atomic. Computer codes for the neutronic analyses were provided by Argonne National Laboratory (ANL) and the assistance of William Woodruff of ANL in helping the NSCR staff to learn the proper use of the codes is gratefully acknowledged. The codes applied in the LEU analyses were WIMSd4/m, DIF3D, NCTRIGA and PARET. These codes allowed full three dimensional, temperature and burnup dependent calculations modelling the NSCR core to be performed for the first time. In addition, temperature coefficients of reactivity and pulsing calculations were carried out in-house, whereas in the past this modelling had been performed at General Atomic. In order to benchmark the newly acquired codes, modelling of the current NSCR core with highly enriched uranium fuel was also carried out. Calculated results were compared to both earlier licensing calculations and experimental data and the new methods were found to achieve excellent agreement with both. Therefore, even if an LEU core is never loaded at the NSCR, this project has resulted in a significant improvement in the nuclear safety analysis capabilities established and maintained at the NSCR.

23596 (DOE/ER/79148–T1) **Reed Reactor Facility. Final report.** Frantz, S.G. Reed Coll., Portland, OR (United States). [1994]. 16p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States);USDOE, Washington, DC (United States);Oregon State Dept. of Energy, Salem, OR (United States). DOE Contract FG06-92ER79148. Order Number DE95015538. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the operation and maintenance of the Reed Reactor Facility. The Reed reactor is mostly used for education and train purposes.

23597 (DUN–4501) **Radiometallurgical examination of K5E fuel failures with behive growth in spires.** Toivonen, R.W. Douglas United Nuclear, Inc., Richland, WA (United States). 19 Jul 1968. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012652. Source: OSTI; NTIS; GPO Dep.

On September 18, 1967, KE Reactor experienced,a failure in a K5E fuel element in tube 2863, exposure 634 Mwd/t. On September 24, 1967, two additional failures occurred. All of these elements, clad with X8001 alloy were from the same canning lot. All fuel elements from this canning lot were termed rupture-prone and were discharged. The elements from five columns including column 2863, but neither columns 2865 nor 3256, were sent to 105-C Basin Fuel Examination Facility for further examination. An incipient failure was found and sent to Radiometallurgy in an effort to determine the cause of failure. During the course of examination, the spire was found to contain beehive-shaped growths approximately 1/8-inch high and 1/8-inch 9 in diameter at the base. The incipient failure contained four of these growths protruding from the spire wall. Closer examination showed that the spire contained numerous other "beehives" in less advanced stages of growth. The ruptured element from 2863 also contained a "beehive". The second section of this report covers examination of several "beehives" and presents information concerning the possible cause or causes of growth.

23598 (HW–3-236) **Canning procedure study barium chloride base flux for bronze bath.** Grills, R.C.; Lewis, E.V.; Jones, K.G. Hanford Works, Richland, WA (United States). 19 Jun 1944. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012706. Source: OSTI; NTIS; GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/fuel rods; FUEL RODS/canning; CANNING; CLEANING; BONDING; PROCESS CONTROL

23599 (HW–54559) **Discussion of Am-Cm alpha correction.** Bunch, W.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 Jan 1958. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013925. Source: OSTI; NTIS; GPO Dep.

Short communication. AMERICIUM ISOTOPES/alpha decay; CURIUM ISOTOPES/alpha decay; HANFORD PRODUCTION REACTORS/reactor physics; PLUTONIUM/production; SEPARATION PROCESSES; CALCULATION METHODS; FUEL ELEMENTS; PLUTONIUM; PRODUCTION

23600 (JAERI-Review–95-005) **Feasibility study on potential productivity of heat-resisting and advanced semiconductors by using the HTTR.** Shibata, Taiju (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 91p. (In Japanese). Order Number DE95789318. Source: OSTI; NTIS; INIS.

Worldwide attention has been paid to GaAs and SiC as a kind of the heat-resisting and advanced semiconductor materials. Doping of specific impurities into semiconductor materials is a key technology for producing semiconductor devices. As one of doping technologies, thermal diffusional doping has been successfully applied to Si. Application of thermal diffusional doping to GaAs needs expensive and complicated processes in order to prevent an occurrence of lattice defects by impurities. On the other hand, it is difficult to apply this technology to SiC, because of small diffusion coefficient of impurities to SiC. Therefore, it is of great importance to develop a substitutional doping technology for these materials for realizing heat-resisting and advanced semiconductor. To dope some impurities into Si crystal by using neutron irradiation is a mature technology and is called NTD. The High Temperature engineering Test Reactor(HTTR) has an unique and superior capability to irradiate large-sized specimen, in the order of 10cm in diameter, at high temperature up to approximately 1000degC. This report presents a result of feasibility study of potential applicability and effectiveness of NTD to GaAs and SiC at the HTTR. First of all, advantages and disadvantages were identified by reviewing the state-of-the-art technology of NTD to Si. Potential applicability of NTD to GaAs and SiC are discussed. Based on this discussion, effectiveness and feasibility of NTD to these materials at the HTTR are examined. As a result, NTD is feasible to SiC but not to GaAs. The HTTR provides the capability to produce SiC semiconductor, in particular, to produce the semiconductor with (1) low irradiation damage, (2) uniform distribution of doped impurities and (3) high productivity, if a large-sized SiC crystal is capable to be commercialized. Practical application of NTD at the HTTR will be discussed in the next study. (author).

23601 (JAERI-Tech–95-002) **Neutronic analysis of JRR-4 with low enriched uranium silicon dispersion type fuel of 3.8g/cm^3 uranium density.** Nakano, Yoshihiro (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 69p. (In Japanese). Order Number DE95789261. Source: OSTI; NTIS; INIS.

Neutronic Analysis of JRR-4 has been performed under the reduced enrichment program of the research reactors. The fuel selected is low enriched uranium silicon dispersion type (silicide fuel) and its uranium density is 3.8g/cm^3. Almost of calculations were done using the SRAC code system developed by JAERI. The results obtained by the calculations are as follows. The reactor core has enough excess reactivity within the range to control and operate the reactor safely. Moderator void, moderator temperature and fuel temperature reactivity coefficients are always negative. Neutron fluxes in irradiation pipes are almost same level as the present core. As a result, the use of the silicide fuel of 3.8g/cm^3 uranium density has been shown to be satisfactory for the core performance required in JRR-4, and has been adopted with the final decision. (author).

23602 (JAERI-Tech–95-020) **Results of physics measurement of the low-enriched uranium fuel core in the JMTR.** Komori, Yoshihiro; Simakawa, Satoshi; Komukai, Bunsaku; Nagao,

Yoshiharu; Akashi, Kazutomo; Sakurai, Fumio. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 69p. (In Japanese). Order Number DE95789302. Source: OSTI; NTIS; INIS.

Reducing enrichment program has been proceeding also in the Japan Atomic Energy Research Institute along with international non-proliferation policy, and the JMTR was fully converted to the low-enriched uranium (LEU) fuel in January, 1994. The silicide fuel with uranium density of 4.8g/cc is used for the JMTR, and cadmium wires are placed in the side plates of the fuel elements as burnable absorber. Based on results of physics measurement on the JMTR LEU fuel core, sufficient shutdown capability and negative reactivity feedback effect were assured. Excess capability and negative reactivity feedback effect were assured. Excess reactivity at the beginning of the operation cycle was maintained at the same level as the previous medium-enriched uranium fuel core due to reactivity effect of the cadmium wires. Excess reactivity change during reactor operation agreed well with the predicted value. (author).

23603 (JAERI-Tech–95-023) **Neutronics analysis on helium production control in stainless steel by neutron spectral tailoring in the JMTR.** Shimakawa, Satoshi (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Komori, Yoshihiro; Nagao, Yoshiharu; Sakurai, Fumio. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 31p. (In Japanese). Order Number DE95789317. Source: OSTI; NTIS; INIS.

With regard to development of neutron spectral tailoring irradiation technique in the JMTR, helium production control range in 304 stainless steel was calculated under constant neutron fluence represented in dpa. Using a technique for enhancing helium production by $^{8}Ni(n,\gamma)^{59}Ni(n,\alpha)^{56}Fe$ reaction, following three irradiation tests were surveyed to estimate helium production control range; (1) thermal neutron cut-off irradiation with cadmium absorber. (2) normal irradiation without considering spectral tailoring, (3) thermal neutron trapping irradiation with graphite moderator. For 200 day irradiation test, helium production in 304 stainless steel is able to be controlled within 1.4-24 appm (2 dpa, He-to-dpa ratio within 0.7-12). Based on the calculation results, it was found that the improved irradiation tests to obtain irradiation data with different helium production is feasible in the JMTR for studies on helium effects in nickel-bearing materials. (author).

23604 (ORNL/M–3563) **HRB-22 preirradiation thermal analysis.** Acharya, R.; Sawa, K. Oak Ridge National Lab., TN (United States). May 1995. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013507. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the preirradiation thermal analysis of the HRB-22 capsule designed for irradiation in the removable beryllium (RB) position of the High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory (ORNL). CACA-2 a heavy isotope and fission product concentration calculational code for experimental irradiation capsules was used to determine time dependent fission power for the fuel compacts. The Heat Engineering and Transfer in Nine Geometries (HEATING) computer code, version 7.2, was used to solve the steady-state heat conduction problem. The diameters of the graphite fuel body that contains the compacts and the primary pressure vessel were selected such that the requirements of running the compacts at an average temperature of $< 1,250$ C and not exceeding a maximum fuel temperature of 1,350 C was met throughout the four cycles of irradiation.

23605 (ORNL/M–3738) **Detailed flux calculations for the conceptual design of the Advanced Neutron Source Reactor.** Wemple, C.A. (EG and G Idaho, Inc., Idaho Falls, ID (United States)). Oak Ridge National Lab., TN (United States). May 1995. 772p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95016131. Source: OSTI; NTIS; INIS; GPO Dep.

A detailed MCNP model of the Advanced Neutron Source Reactor has been developed. All reactor components inside the reflector tank were included, and all components were highly segmented. Neutron and photon multigroup flux spectra have been calculated for each segment in the model, and thermal-to-fast neutron flux ratios were determined for each component segment. Axial profiles of the spectra are provided for all components of the reactor. Individual segment statistical uncertainties were limited wherever possible, and the group fluxes for all important reflector components have a standard deviation below 10%.

23606 (ORNL/M–3993) **Detailed heat load calculations at the beginning, middle, and end of cycle for the conceptual design of the Advanced Neutron Source Reactor.** Wemple, C.A. (Idaho National Engineering Lab., Idaho Falls, ID (United States)); Schnitzler, B.G. Oak Ridge National Lab., TN (United States). Feb 1995. 212p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012539. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Neutron Source (ANS) is a world-class research reactor and experimental center for neutron research, presently being designed at the Oak Ridge National Laboratory (ORNL). The reactor consists of a 330-MW(f) highly enriched uranium core, which is cooled, moderated, and reflected with heavy water. When completed, it will be the preeminent ultrahigh neutron flux reactor in the world, with facilities for research programs in biology, materials science, chemistry, fundamental and nuclear physics, and analytical chemistry. Irradiation facilities are provided for a variety of isotope production capabilities, as well as materials irradiation. The ANS reactor design, at the time of this report, has completed the conceptual design phase and entered the advanced conceptual design phase. This report is part of an effort to fully document the analysis methods and results for the conceptual design. It details the methods used to perform heat load calculations on the ANS reactor design, describes the model used, and gives the resulting heat loads in all components of the reactor, in both a differential (by segment) and integral (by component) fashion. These heat load data are provided at three times within the ANS fuel cycle - at beginning (0 days), middle (8.5 days), and end (17 days) of cycle. The remainder of the report is dedicated to this description. In Chapter 2, some necessary background on the reactor design is provided. Chapters 3 and 4 give details of the depletion methods used and revisions to previous MCNP models. Chapter 5 analyzes the results of these calculations, and Chapter 6 provides a summary and conclusions.

23607 (SAND–95-1107C) **Observations of the boiling process from a downward-facing torispherical surface: Confirmatory testing of the heavy water new production reactor flooded cavity design.** Chu, T.Y.; Bentz, J.H.; Simpson, R.B. Sandia National Labs., Albuquerque, NM (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950828–12: National heat transfer conference, Portland, OR (United States), 5-9 Aug 1995). Order Number DE95013031. Source: OSTI; NTIS; INIS; GPO Dep.

Reactor-scale ex-vessel boiling experiments were performed in the CYBL facility at Sandia National Laboratories. The boiling flow pattern outside the RPV bottom head shows a center pulsating region and an outer steady two-phase boundary layer region. The local heat transfer data can be correlated in terms of a modified Rohsenow correlation.

23608 (WHC-SD-FF-CSWD–055-Rev.1) **R-1 (C-620-A) and R-2 (C-620-B) air compressor control logic, computer software description. Revision 1.** Walter, K.E. Westinghouse Hanford Co., Richland, WA (United States). 8 Jun 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014314. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides an updated computer software description for the software used on the FFTF R-1 (C-620-A) and R-2 (C-620-B) air compressor programmable controllers. Logic software design changes were required to allow automatic starting of a compressor that had not been previously started.

23609 (WHC-SD-FF-CSWD–056-Rev.1) **R-189 (C-620) air compressor control logic software documentation. Revision 1.** Walter, K.E. Westinghouse Hanford Co., Richland, WA (United States). 8 Jun 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014313. Source: OSTI; NTIS; INIS; GPO Dep.

This relates to FFTF plant air compressors. Purpose of this document is to provide an updated Computer Software Description for the software to be used on R-189 (C-620-C) air compressor

programmable controllers. Logic software design changes were required to allow automatic starting of a compressor that had not been previously started.

23610 (WHC-SD-FF-MAR–001) **FFTF Plant transition mission analysis report.** Lund, D.P. Westinghouse Hanford Co., Richland, WA (United States). 25 May 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013564. Source: OSTI; NTIS; INIS; GPO Dep.

FFTF (Fast Flux Test Facility) is a 400-MW(t) sodium-cooled, fast flux test reactor at Hanford, designed to test fuels and materials for advanced nuclear power plants; it has no capability for generating electric power. Since a long-term mission could not be found for FFTF, it was placed in standby, and a recommendation was made that it be shut down. Purpose of the FFTF Transition Project is to prepare it for Decontamination and Decommissioning; this will be accomplished by establishing a passively safe and environmentally secure configuration, that can be preserved for several decades. This report presents the results of the mission analysis, which is required by Hanford systems engineering procedures.

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Refer also to citation(s) 23131, 23558, 23559, 23567, 23590, 23595, 24018, 24443

23611 (ANL/ET/CP–83008) **Review of behavior of mixed-oxide fuel elements in extended overpower transient tests in EBR-II.** Tsai, H. (Argonne National Lab., IL (United States). Energy Technology Div.); Neimark, L.A.; Nagai, S.; Nakae, N. Argonne National Lab., IL (United States). Oct 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950426–5: 3. international conference on nuclear engineering, Kyoto (Japan), 23-27 Apr 1995). Order Number DE95013682. Source: OSTI; NTIS; INIS; GPO Dep.

From a series of five tests conducted in EBR-II, a substantial data base has been established on the performance of mixed-oxide fuel elements in a liquid-metal-cooled reactor under slow-ramp transient overpower conditions. Each test contained 19 preirradiated fuel elements with varying design and prior operating histories. Elements with aggressive design features, such as high fuel smear density and/or thin cladding, were included to accentuate transient effects. The ramp rates were either 0.1 or 10% $\Delta P/P/s$ and the overpowers ranged between $\approx$60 and 100% of the elements' prior power ratings. Six elements breached during the tests, all with aggressive design parameters. The other elements, including all those with moderate design features for the reference or advanced long-life drivers for PNC's prototype fast reactor Monju, maintained their cladding integrity during the tests. Posttest examination results indicated that fuel/cladding mechanical interaction (FCMI) was the most significant mechanism causing the cladding strain and breach. In contrast, pressure loading from the fission gas in the element plenum was less important, even in high-burnup elements. During an overpower transient, FCMI arises from fuel/cladding differential thermal expansion, transient fuel swelling, and, significantly, the gas pressure in the sealed central cavity of elements with substantial centerline fuel melting. Fuel performance data from these tests, including cladding breaching margin and transient cladding strain, are correlatable with fuel-element design and operating parameters. These correlations are being incorporated into fuel-element behavior codes. At the two tested ramp rates, fuel element behavior appears to be insensitive to transient ramp rate and there appears to be no particular vulnerability to slow ramp transients as previously perceived.

23612 (ANL/IFR/CP–85456) **Probabilistic techniques using Monte Carlo sampling for multi- component system diagnostics.** Aumeier, S.E. (Argonne National Lab., Idaho Falls, ID (United States)); Lee, J.C.; Akcasu, A.Z. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38 ; FG02-92ER75712. (CONF-950420–25: International conference on mathematics and computations, reactor physics, and environmental analyses, Portland, OR (United States), 30 Apr - 4 may 1995). Order Number DE95012283. Source: OSTI; NTIS; INIS; GPO Dep.

We outline the structure of a new approach at multi-component system fault diagnostics which utilizes detailed system simulation models, uncertain system observation data, statistical knowledge of system parameters, expert opinion, and component reliability data in an effort to identify incipient component performance degradations of arbitrary number and magnitude. The technique involves the use of multiple adaptive Kalman filters for fault estimation, the results of which are screened using standard hypothesis testing procedures to define a set of component events that could have transpired. Latin Hypercube sample each of these feasible component events in terms of uncertain component reliability data and filter estimates. The capabilities of the procedure are demonstrated through the analysis of a simulated small magnitude binary component fault in a boiling water reactor balance of plant. The results show that the procedure has the potential to be a very effective tool for incipient component fault diagnosis.

23613 (BNL–52445-Rev.1-(FORMAL)) **Aircraft impact analysis for the HFBR. Revision 1.** Stock, D.; Biele, F. Brookhaven National Lab., Upton, NY (United States). Feb 1993. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95011784. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents an analysis performed to determine the annual frequency at which aircraft are expected to strike the High Flux Beam Reactor (HFBR) complex, located at Brookhaven National Laboratory. Since the HFBR is not hardened against light aircraft, this report considers the impact of military, commercial, twin engine and knee engine aircraft operating in the vicinity of the HFBR. The large volume of light aircraft operating in this area contributes heavily to the estimated annual impact frequency of 3.54E-05 impacts per year. There are two chapters and seven appendices in this report. The first chapter describes the airspace in the vicinity of the HFBR. This includes five airports, two major airways, one standard arrival route, as well as a significant volume of radar vectored and air-taxi traffic. The second chapter of this report presents the calculations by which the expected impact frequency was derived, and an assessment of the uncertainty in those calculations. The calculations were performed using the method outlined in the NRC Standard Review Plan. A separate set of calculations is presented for each of three sources of aircraft: airway traffic, Brookhaven Airport, and Calverton Airport. The appendices contain discussions and side calculations ancillary to the presentation in the second section. This includes a discussion of the data used to estimate traffic counts, information on accident rates, and several other points which would have only been distracting if included in the main discussion.

23614 (CONF-950564–1) **Design and testing of integrated circuits for reactor protection channels.** Battle, R.E. (Oak Ridge National Lab., TN (United States)); Vandermolen, R.I.; Jagadish, U.; Swail, B.K.; Naser, J. Oak Ridge National Lab., TN (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States);Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC05-84OR21400. From 9. symposium on power plant dynamics, control and testing; Knoxville, TN (United States); 24-26 May 1995. Order Number DE95013224. Source: OSTI; NTIS; INIS; GPO Dep.

Custom and semicustom application-specific integrated circuit design and testing methods are investigated for use in research and commercial nuclear reactor safety systems. The Electric Power Research Institute and Oak Ridge National Laboratory are working together through a cooperative research and development agreement to apply modern technology to a nuclear reactor protection system. The purpose of this project is to demonstrate to the nuclear industry an alternative approach for new or upgrade reactor protection and safety system signal processing and voting logic. Motivation for this project stems from (1) the difficulty of proving that software-based protection systems are adequately reliable, (2) the obsolescence of the original equipment, and (3) the improved performance of digital processing. A demonstration model for protection system of PWR reactor has been designed and built.

23615 (DOE/ER/12900–1) **Characterization of jet breakup mechanisms observed from simulant of molten fuel pentrating coolant. Technical progress report, 1989–1990.** Jones, B.G. Illinois Univ., Urbana, IL (United States). Dept. of Nuclear Engineering. [1990]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER12900. Order Number DE95014739. Source: OSTI; NTIS; GPO Dep.

The objective of the proposed experiments is to replicate approximately, by injecting low melting point metal alloys into Freon-11 and liquid nitrogen, the dispersal of corium streams in water. To first gain a better understanding of the corium dispersal process to be simulated, experimental data from the CCM experiments, in which the injection of streams of molten corium into water was studied, was interpreted in cooperation with Argonne National Laboratory (ANL) staff. The results of these experiments are discussed briefly below. This is followed by a description of the preparations made to date for the present simulant experiments.

23616 (ENEA-RT-INN–95-09) **Decommissioning of IFEC.** Ceccotti, G. (ENEA, Saluggia (Italy). Centro Ricerche Energia - Area Energia e Innovazione); Sberze, L. ENEA, Saluggia (Italy). Centro Ricerche Energia - Area Energia e Innovazione. May 1995. 54p. (In Italian). Order Number DE95789754. Source: OSTI; NTIS (US Sales Only).

The IFEC nuclear fuel fabrication plant operated in Italy for more then thirty years and has now been successfully decommissioned. The rules and regulations relating to Quality Assurance established during the fabrication of Cirene reactor fuel have been adhered to during the decommissioning phase. The use of personnel with large experience in the nuclear field has resulted in vast majority of cares of material and apparatus to be reutilized in conventional activities without the need of calling on the assistence of external firms. The whole decontamination process was successfully completed on time and in particular the quantity of contaminated wastes was kept to eminimun.

23617 (FZR–84) **Development and verification of a three-dimensional core model for WWR type reactors and its coupling with the accident code ATHLET. Final report.** Grundmann, U.; Lucas, D.; Mittag, S.; Rohde, U. Forschungszentrum Rossendorf e.V. (FZR), Rossendorf bei Dresden (Germany). Apr 1995. 128p. (In German). Sponsored by Bundesministerium fuer Bildung, Wissenschaft, Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMBF 1500925. Order Number DE95795719. Source: OSTI; NTIS (US Sales Only); INIS.

The main goal of the project was the coupling of the 3D core model DYN3D for Russian VVER-type reactors, which has been developed in the RCR, with the thermohydraulic code ATHLET. The coupling has been realized on two basically different ways: - The implementation of only the neutron kinetics model of DYN3D into ATHLET (internal coupling), - the connection of the complete DYN3D core model including neutron kinetics, thermohydraulics and fuel rod model via data interfaces at the core top and bottom (external coupling). For the test of the coupling, comparative calculations between internal and external coupling versions have been carried out for a LOCA and a reactivity transient. Complementary goals of the project were: - The development of a DYN3D version for burn-up calculations, - the verification of DYN3D on benchmark tasks and experimental data on fuel rod behaviour, - a study on the extension of the neutron-physical data base. The project contributed to the development of advanced tools for the safety analysis of VVER-type reactors. Future work is aimed to the verification of the coupled code complex DYN3D-ATHLET. (orig.)

23618 (IKE–2-110) **Verification of KESS-III using PHEBUS in-pile experiments. Status report. Verification and completion of KESS-III.** Hocke, K.D.; Kronenberg, J.; Mueller, K.; Schlenkrich, C.; Schatz, A. Stuttgart Univ. (Germany). Inst. fuer Kernenergetik und Energiesysteme. May 1994. 74p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 1500750A. Order Number DE95795737. Source: OSTI; NTIS (US Sales Only); INIS.

The Phebus SFD test objectives were related to the early phases of severe accidents core heatup and degradation, comprising processes which become relevant prior to the onset of significant core degradation in the reactor core or bundle region. The orientation of the Phebus SFD test matrix on code development and verification needs, with appropriate measurements and post-test examinations, made these tests particularly suitable for verification of physical models and their interactions as well as for the improvement of applicability of the entire KESS code system. A brief summary of pre-test calculations in support of the Phebus FP programme is also included. These analyses aimed at verifying the dimensioning and test procedures of the first experiment FPT-0 conducted at the end of 1993, comprising code-to-code comparisons with a number of code systems available internationally. IKE participation to the International Standard Problem ISP-No.28 (Phebus test B9+) and in activities of the Phebus-related scientific working groups GTI (Phebus SFD) and SAWG (Phebus FP) allowed further model and code comparison on an international level, leading to additional improvement and extension of KESS model details, code optimization, data acquisition and post processing tools. (orig./HP)

23619 (LA-UR–93-3564) **Assessment of the PIUS physics and thermal-hydraulic experimental data bases.** Boyack, B.E. (Los Alamos National Lab., NM (United States). Technology and Safety Assessment Div.). Los Alamos National Lab., NM (United States). [1993]. 130p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95014572. Source: OSTI; NTIS; INIS; GPO Dep.

The PIUS reactor utilizes simplified, inherent, passive, or other innovative means to accomplish safety functions. Accordingly, the PIUS reactor is subject to the requirements of 10CFR52.47(b)(2)(i)(A). This regulation requires that the applicant adequately demonstrate the performance of each safety feature, interdependent effects among the safety features, and a sufficient data base on the safety features of the design to assess the analytical tools used for safety analysis. Los Alamos has assessed the quality and completeness of the existing and planned data bases used by Asea Brown Boveri to validate its safety analysis codes and other relevant data bases. Only a limited data base of separate effect and integral tests exist at present. This data base is not adequate to fulfill the requirements of 10CFR52.47(b)(2)(i)(A). Asea Brown Boveri has stated that it plans to conduct more separate effect and integral test programs. If appropriately designed and conducted, these test programs have the potential to satisfy most of the data base requirements of 10CFR52.47(b)(2)(i)(A) and remedy most of the deficiencies of the currently existing combined data base. However, the most important physical processes in PIUS are related to reactor shutdown because the PIUS reactor does not contain rodded shutdown and control systems. For safety-related reactor shutdown, PIUS relies on negative reactivity insertions from the moderator temperature coefficient and from boron entering the core from the reactor pool. Asea Brown Boveri has neither developed a direct experimental data base for these important processes nor provided a rationale for indirect testing of these key PIUS processes. This is assessed as a significant shortcoming. In preparing the conclusions of this report, test documentation and results have been reviewed for only one integral test program, the small-scale integral tests conducted in the ATLE facility.

23620 (LA-UR–95-1594) **Updated TRAC analysis of an 80% double-ended cold-leg break for the AP600 design.** Lime, J.F. (Los Alamos National Lab., NM (United States). Technology and Safety Assessment Div.); Boyack, B.E. Los Alamos National Lab., NM (United States). [1995]. 152p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015287. Source: OSTI; NTIS; INIS; GPO Dep.

An updated TRAC 80% large-break loss-of-coolant accident (LBLOCA) has been calculated for the Westinghouse AP600 advanced reactor design, The updated calculation incorporates major code error corrections, model corrections, and plant design changes. The 80% break size was calculated by Westinghouse to be the most severe large-break size for the AP600 design. The LBLOCA transient was calculated to 144 s. Peak cladding temperatures (PCTS) were well below the Appendix K limit of 1,478 K (2,200 F), but very near the cladding oxidation temperature of 1,200 K (1,700 F). Transient event times and PCT for the TRAC calculation were in reasonable agreement with those calculated by

Westinghouse using their WCOBRA/TRAC code. However, there were significant differences in the detailed phenomena calculated by the two codes, particularly during the blowdown phase. The reasons for these differences are still being investigated. Additional break sizes and break locations need to be analyzed to confirm the most severe break postulated by Westinghouse.

23621 (NUREG–0847-Suppl.-No.15) **Safety evaluation report related to the operation of Watts Bar Nuclear Plant, Units 1 and 2 (Docket Nos. 50-390 and 50-391). Supplement No. 15.** Tam, P.S. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Reactor Projects I/II. Jun 1995. 184p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This report supplements the Safety Evaluation Report (SER), NUREG-0847 (June 1982), Supplement No. 1 (September 1982), Supplement No. 2 (January 1984), Supplement No. 3 (January 1985), Supplement No. 4 (March 1985), Supplement No. 5 (November 1990), Supplement No. 6 (April 1991), Supplement No. 7 (September 1991), Supplement No. 8 (January 1992), Supplement No. 9 (June 1992), Supplement No. 10 (October 1992), Supplement No. 11 (April 1993), Supplement No. 12 (October 1993), Supplement No. 13 (April 1994), and Supplement No. 14 (December 1994) issued by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission with respect to the application filed by the Tennessee Valley Authority, as applicant and owner, for licenses to operate the Watts Bar Nuclear Plant, Units 1 and 2 (Docket Nos. 50-390 and 50-391). The facility is located in Rhea County, Tennessee, near the Watts Bar Dam on the Tennessee River. This supplement provides recent information regarding resolution of some of the outstanding and confirmatory items, and proposed license conditions identified in the SER.

23622 (NUREG–1430-Vol.3-Rev.1) **Standard technical specifications: Babcock and Wilcox plants. Volume 3, Revision 1: Bases (Sections 3.4–3.9).** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Apr 1995. 381p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS.

This report documents the results of the combined effort of the NRC and the industry to produce improved Standard Technical Specifications (STS), Revision 1 for Babcock and Wilcox Plants. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993. The improved STS will be used as the basis for individual nuclear power plant licensees to develop improved plant-specific technical specifications. This report contains three volumes. Volume 1 contains the Specifications for all chapters and sections of the improved STS. Volume 2 contains the Bases for Chapters 2.0 and 3.0, and Sections 3.1–3.3 of the improved STS. Volume 3 contains the Bases for Sections 3.4–3.9 of the improved STS.

23623 (NUREG–1432-Vol.1-Rev.1) **Standard technical specifications: Combustion engineering plants. Volume 1, Revision 1: Specifications.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Apr 1995. 433p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report documents the results of the combined effort of the NRC and the industry to produce improved Standard Technical Specifications (STS), Revision 1 for Combustion Engineering Plants. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993. The improved STS will be used as the basis for individual nuclear power plant licensees to develop improved plant-specific technical specifications. This report contains three volumes. Volume 1 contains the Specifications for all chapters and sections of the improved STS. Volume 2 contains the Bases for Chapters 2.0 and 3.0, and Sections 3.1–3.3 of the improved STS. Volume 3 contains the Bases for Sections 3.4–3.9 of the improved STS.

23624 (NUREG–1432-Vol.3-Rev.1) **Standard technical specifications: Combustion engineering plants. Volume 3, Revision 1: Bases (Sections 3.4–3.9).** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Apr 1995. 444p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report documents the results of the combined effort of the NRC and the industry to produce improved Standard Technical Specifications (STS), Revision 1 for Combustion Engineering Plants. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993. The improved STS will be used as the basis for individual nuclear power plant licensees to develop improved plant-specific technical specifications. This report contains three volumes. Volume 1 contains the Specifications for all chapters and sections of the improved STS. Volume 2 contains the Bases for Chapters 2.0 and 3.0, and Sections 3.1–3.3 of the improved STS Volume 3 contains the Bases for Sections 3.4–3.9 of the improved STS.

23625 (NUREG–1433-Vol.1-Rev.1) **Standard technical specifications: General Electric plants, BWR/4. Volume 1, Revision 1: Specifications.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Apr 1995. 382p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report documents the results of the combined effort of the NRC and the industry to produce improved Standard Technical Specifications (STS), Revision 1 for General Electric BWR/4 Plants. The changes reflected in Revision 1 resulted from the experience gained from license amendment applications to convert to these improved STS or to adopt partial improvements to existing technical specifications. This NUREG is the result of extensive public technical meetings and discussions between the Nuclear Regulatory Commission (NRC) staff and various nuclear power plant licensees, Nuclear Steam Supply System (NSSS) Owners Groups, NSSS vendors, and the Nuclear Energy Institute (NEI). The improved STS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993. The improved STS will be used as the basis for individual nuclear power plant licensees to develop improved plant-specific technical specifications. This report contains three volumes. Volume 1 contains the Specifications for all chapters and sections of the improved STS. Volume 2 contains the Bases for Chapters 2.0 and 3.0, and Sections 3.1–3.3 of the improved STS. Volume 3 contains the Bases for Sections 3.4–3.10 of the improved STS.

23626 (NUREG–1526) **Lessons learned from early implementation of the maintenance rule at nine nuclear power plants.** Petrone, C.D.; Correia, R.P.; Black, S.C. Nuclear Regulatory Commission, Washington, DC (United States). Div. of

Technical Support. Jun 1995. 34p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This report summarizes the lessons learned from the nine pilot site visits that were performed to review early implementation of the maintenance rule using the draft NRC Maintenance Inspection Procedure. Licensees followed NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." In general, the licensees were thorough in determining which structures, systems, and components (SSCS) were within the scope of the maintenance rule at each site. The use of an expert panel was an appropriate and practical method of determining which SSCs are risk significant. When setting goals, all licensees considered safety but many licensees did not consider operating experience throughout the industry. Although required to do so, licensees were not monitoring at the system or train level the performance or condition for some systems used in standby service but not significant to risk. Most licensees had not established adequate monitoring of structures under the rule. Licensees established reasonable plans for doing periodic evaluations, balancing unavailability and reliability, and assessing the effect of taking equipment out of service for maintenance. However, these plans were not evaluated because they had not been fully implemented at the time of the site visits.

23627 (NUREG/CR–5857) **Aging of turbine drives for safety-related pumps in nuclear power plants.** Cox, D.F. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering Technology; Oak Ridge National Lab., TN (United States). Jun 1995. 50p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (ORNL–6713). Source: OSTI; NTIS; GPO; INIS.

This study was performed to examine the relationship between time-dependent degradation and current industry practices in the areas of maintenance, surveillance, and operation of steam turbine drives for safety-related pumps. These pumps are located in the Auxiliary Feedwater (AFW) system for pressurized-water reactor plants and in the Reactor Core Isolation Cooling and High-Pressure Coolant Injection systems for boiling-water reactor plants. This research has been conducted by examination of failure data in the Nuclear Plant Reliability Data System, review of Licensee Event Reports, discussion of problems with operating plant personnel, and personal observation. The reported failure data were reviewed to determine the cause of the event and the method of discovery. Based on the research results, attempts have been made to determine the predictability of failures and possible preventive measures that may be implemented. Findings in a recent study of AFW systems indicate that the turbine drive is the single largest contributor to AFW system degradation. However, examination of the data shows that the turbine itself is a reliable piece of equipment with a good service record. Most of the problems documented are the result of problems with the turbine controls and the mechanical overspeed trip mechanism; these apparently stem from three major causes which are discussed in the text. Recent improvements in maintenance practices and procedures, combined with a stabilization of the design, have led to improved performance resulting in a reliable safety-related component. However, these improvements have not been universally implemented.

23628 (NUREG/CR–5954) **Effect of aging on the PWR Chemical and Volume Control System.** Grove, E.J. (Brookhaven National Lab., Upton, NY (United States)); Travis, R.J.; Aggarwal, S.K. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering Technology; Brookhaven National Lab., Upton, NY (United States). Jun 1995. 185p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52410). Source: OSTI; NTIS; GPO; INIS.

The PWR Chemical and Volume Control System (CVCS) is designed to provide both safety and non-safety related functions. During normal plant operation it is used to control reactor coolant chemistry, and letdown and charging flow. In many plants, the charging pumps also provide high pressure injection, emergency boration, and RCP seal injection in emergency situations. This study examines the design, materials, maintenance, operation and actual degradation experiences of the system and main subcomponents to assess the potential for age degradation. A detailed review of the Nuclear Plant Reliability Data System (NPRDS) and Licensee Event Report (LER) databases for the 1988–1991 time period, together with a review of industry and NRC experience and research, indicate that age-related degradations and failures have occurred. These failures had significant effects on plant operation, including reactivity excursions, and pressurizer level transients. The majority of these component failures resulted in leakage of reactor coolant outside the containment. A representative plant of each PWR design (W, CE, and B and W) was visited to obtain specific information on system inspection, surveillance, monitoring, and inspection practices. The results of these visits indicate that adequate system maintenance and inspection is being performed. In some instances, the frequencies of inspection were increase in response to repeated failure events. A parametric study was performed to assess the effect of system aging on Core Damage Frequency (CDF). This study showed that as motor-operated valve (MOV) operating failures increased, the contribution of the High Pressure Injection to CDF also increased.

23629 (NUREG/CR–6144-Vol.6-Pt.2) **Evaluation of potential severe accidents during low power and shutdown operations at Surry, Unit 1: Evaluation of severe accident risk during mid-loop operations. Volume 6, Part 2: Appendices.** Jo, J. (Brookhaven National Lab., Upton, NY (United States)); Lin, C.C.; Neymotin, L.; Mubayi, V. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Technology; Brookhaven National Lab., Upton, NY (United States). May 1995. 242p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52399-Vol.6-Pt.2). Source: OSTI; NTIS; GPO; INIS.

The objectives are to assess the risks of severe accidents initiated during plant operational states other than full power operation and to compare the estimated core damage frequencies, important accident sequences and other qualitative and quantitative results with those accidents initiated during full power operation. In phase 2, mid-loop operation was selected as the plant configuration to be analyzed. Volume 1 summarizes the results of the study. The scope of the level-1 study includes plant damage state analyses, and uncertainty analysis. The internal event analysis is documented in Volume 2. The internal fire and internal flood analysis are documented in Volumes 3 and 4, respectively. A separate study on seismic analysis, documented in Volume 5, was performed for the NRC by Future Resources Associated, Inc. A phased approach was used in the level 2/3 PRA program, however both phases addressed the risk from only mid-loop operation. The first phase of the level 2/3 PRA was initiated in late 1991 and consisted of an Abridged Risk Study. This study was completed in May 1992 and was focused on accident progression and consequences, conditional on core damage. Phase 2 is a more detailed study in which an evaluation of risk during mid-loop operation was performed. The results of the phase 2 level 2/3 study are the subject of this volume of NUREG/CR-6144, Volume 6. This report, Volume 6, Part 2, consists of five appendices containing supporting information for: the PDS (plant damage state) analysis; the accident progression analysis; the source term analysis; the consequence analysis; and the Melcor analysis. 73 figs., 21 tabs.

23630 (NUREG/CR–6174-Vol.1) **Revised analyses of decommissioning for the reference boiling water reactor power station. Effects of current regulatory and other considerations on the financial assurance requirements of the decommissioning rule and on estimates of occupational radiation exposure: Main report, draft report for comment. Volume 1.** Smith, R.I. (Pacific Northwest Lab., Richland, WA (United States)); Bierschbach, M.C.; Konzek, G.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications. Sep 1994. 144p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–9975-Vol.1). Source: OSTI; NTIS; GPO; INIS.

On June 27, 1988, the U.S. Nuclear Regulatory Commission (NRC) published in the Federal Register (53 FR 24018) the final rule for the General Requirements for Decommissioning Nuclear

Facilities. With the issuance of the final rule, owners and operators of licensed nuclear power plants are required to prepare, and submit to the NRC for review, decommissioning plans and cost estimates. The NRC staff is in need of updated bases documentation that will assist them in assessing the adequacy of the licensee submittals, from the viewpoint of both the planned actions, including occupational radiation exposure, and the probable costs. The purpose of this reevaluation study is to update the needed bases documentation. This report presents the results of a review and reevaluation of the PNL 1980 decommissioning study of the Washington Public Power Supply System's Washington Nuclear Plant Two (WNP-2), including all identifiable factors and cost assumptions which contribute significantly to the total cost of decommissioning the plant for the DECON, SAFSTOR, and ENTOMB alternatives, which now include an initial 5-7 year period during which time the spent fuel is stored in the spent fuel pool prior to beginning major disassembly or extended safe storage of the plant. This report also includes consideration of the NRC requirement that decontamination and decommissioning activities leading to termination of the nuclear license be completed within 60 years of final reactor shutdown, consideration of packaging and disposal requirements for materials whose radionuclide concentrations exceed the limits for Class C low-level waste. Costs for labor, transport, and disposal activities are given in 1993 dollars. Sensitivities of the total license termination cost to the disposal costs at different low-level radioactive waste disposal sites, to different depths of contaminated concrete surface removal within the facilities, and to different transport distances are also examined.

23631 (NUREG/CR–6174-Vol.2) **Revised analyses of decommissioning for the reference boiling water reactor power station. Effects of current regulatory and other considerations on the financial assurance requirements of the decommissioning rule and on estimates of occupational radiation exposure: Appendices, draft report for comment. Volume 2.** Smith, R.I. (Pacific Northwest Lab., Richland, WA (United States)); Bierschbach, M.C.; Konzek, G.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Pacific Northwest Lab., Richland, WA (United States). Sep 1994. 288p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–9975-Vol.2). Source: OSTI; NTIS; GPO; INIS.

On June 27, 1988, the U.S. Nuclear Regulatory Commission (NRC) published in the Federal Register (53 FR 24018) the final rule for the General Requirements for Decommissioning Nuclear Facilities. With the issuance of the final rule, owners and operators of licensed nuclear power plants are required to prepare, and submit to the NRC for review, decommissioning plans and cost estimates. The NRC staff is in need of updated bases documentation that will assist them in assessing the adequacy of the licensee submittals, from the viewpoint of both the planned actions, including occupational radiation exposure, and the probable costs. The purpose of this reevaluation study is to update the needed bases documentation. This report presents the results of a review and reevaluation of the PNL 1980 decommissioning study of the Washington Public Power Supply System's WNP-2, including all identifiable factors and cost assumptions which contribute significantly to the total cost of decommissioning the plant for the DECON, SAFSTOR, and ENTOMB decommissioning alternatives, which now include an initial 5-7 year period during which time the spent fuel is stored in the spent fuel pool prior to beginning major disassembly or extended safe storage of the plant. This report also includes consideration of the NRC requirement that decontamination and decommissioning activities leading to termination of the nuclear license be completed within 60 years of final reactor shutdown, consideration of packaging and disposal requirements for materials whose radionuclide concentrations exceed the limits for Class C low-level waste. Costs for labor, materials, transport, and disposal activities are given in 1993 dollars. Sensitivities of the total license termination cost to the disposal costs at different low-level radioactive waste disposal sites, to different depths of contaminated concrete surface removal within the facilities, and to different transport distances are also examined.

23632 (NUREG/CR–6263-Vol.1) **High integrity software for nuclear power plants: Candidate guidelines, technical basis and research needs. Executive summary: Volume 1.** Seth, S. (Mitre Corp., McLean, VA (United States)); Bail, W.; Cleaves, D.; Cohen, H.; Hybertson, D.; Schaefer, C.; Stark, G.; Ta, A.; Ulery, B. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Technology; Mitre Corp., McLean, VA (United States). Jun 1995. 78p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (MTR–94W0000114-Vol.1). Source: OSTI; NTIS; INIS; GPO.

The work documented in this report was performed in support of the US Nuclear Regulatory Commission to examine the technical basis for candidate guidelines that could be considered in reviewing and evaluating high integrity computer software used in the safety systems of nuclear power plants. The framework for the work consisted of the following software development and assurance activities: requirements specification; design; coding; verification and validation, including static analysis and dynamic testing; safety analysis; operation and maintenance; configuration management; quality assurance; and planning and management. Each activity (framework element) was subdivided into technical areas (framework subelements). The report describes the development of approximately 200 candidate guidelines that span the entire range of software life-cycle activities; the assessment of the technical basis for those candidate guidelines; and the identification, categorization and prioritization of research needs for improving the technical basis. The report has two volumes: Volume 1, Executive Summary, includes an overview of the framework and of each framework element, the complete set of candidate guidelines, the results of the assessment of the technical basis for each candidate guideline, and a discussion of research needs that support the regulatory function; Volume 2 is the main report.

23633 (NUREG/CR–6270) **Estimating boiling water reactor decommissioning costs. A user's manual for the BWR Cost Estimating Computer Program (CECP) software: Draft report for comment.** Bierschbach, M.C. (Pacific Northwest Lab., Richland, WA (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications. Dec 1994. 178p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–10086). Source: OSTI; NTIS; GPO; INIS.

With the issuance of the Decommissioning Rule (July 27, 1988), nuclear power plant licensees are required to submit to the U.S. Regulatory Commission (NRC) for review, decommissioning plans and cost estimates. This user's manual and the accompanying Cost Estimating Computer Program (CECP) software provide a cost-calculating methodology to the NRC staff that will assist them in assessing the adequacy of the licensee submittals. The CECP, designed to be used on a personal computer, provides estimates for the cost of decommissioning BWR power stations to the point of license termination. Such cost estimates include component, piping, and equipment removal costs; packaging costs; decontamination costs; transportation costs; burial costs; and manpower costs. In addition to costs, the CECP also calculates burial volumes, person-hours, crew-hours, and exposure person-hours associated with decommissioning.

23634 (SAND–95-1035C) **CONTAIN code analyses of direct containment heating (DCH) experiments.** Williams, D.C.; Griffith, R.O.; Tadios, E.L.; Washington, K.E. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951006–2: Winter meeting of the American Nuclear Society, San Francisco, CA (United States), 29 Oct - 1 nov 1995). Order Number DE95013029. Source: OSTI; NTIS; INIS; GPO Dep.

In some nuclear reactor core melt accidents, a potential exists for molten core debris to be dispersed into the containment under high pressure. Resulting energy transfer to the containment atmosphere can pressurize the containment. This process, known as direct containment heating (DCH), has been the subject of extensive experimental and analytical programs sponsored by the US Nuclear Regulatory Commission (NRC). DCH modeling has been a major focus for the development of the CONTAIN code. In support of the peer review, extensive analyses of DCH experiments were

performed in order to assess the CONTAIN code's DCH models and improve understanding of DCH phenomenology. The present paper summarizes this assessment effort.

23635 (SAND–95-1036C) **CONTAIN code analyses of direct containment heating (DCH) experiments: Model assessment and phenomenological interpretation.** Williams, D.C.; Griffith, R.O.; Tadios, E.L.; Washington, K.E. Sandia National Labs., Albuquerque, NM (United States). 12 May 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951006–1: Winter meeting of the American Nuclear Society, San Francisco, CA (United States), 29 Oct - 1 nov 1995). Order Number DE95013028. Source: OSTI; NTIS; INIS; GPO Dep.

Models for direct containment heating (DCH) in the CONTAIN code for severe accident analysis have been reviewed and a standard input prescription for their use has been defined. The code has been exercised against a large subset of the available DCH data base. Generally good agreement with the experimental results for containment pressurization (ΔP) and hydrogen generation has been obtained. Extensive sensitivity studies have been performed which permit assessment of many of the strengths and weaknesses of specific model features. These include models for debris transport and trapping, DCH heat transfer and chemistry, atmosphere-structure heat transfer, interactions between nonairborne debris and blowdown steam, potential effects of debris-water interactions, and hydrogen combustion under DCH conditions. Containment compartmentalization is an important DCH mitigator in the calculations, in agreement with experimental results. The CONTAIN model includes partially parametric treatments for some processes that are not well understood. The importance of the associated uncertainties depends upon the details of the DCH scenario being analyzed. Recommended sensitivity studies are summarized that allow the user to obtain a reasonable estimate of the uncertainties in the calculated results.

23636 (SAND–95-1361) **Aging assessment for active fire protection systems.** Ross, S.B. (Science and Engineering Associates, Inc. (United States)); Nowlen, S.P.; Tanaka, T. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015733. Source: OSTI; NTIS; INIS; GPO Dep.

This study assessed the impact of aging on the performance and reliability of active fire protection systems including both fixed fire suppression and fixed fire detection systems. The experience base shows that most nuclear power plants have an aggressive maintenance and testing program and are finding degraded fire protection system components before a failure occurs. Also, from the data reviewed it is clear that the risk impact of fire protection system aging is low. However, it is assumed that a more aggressive maintenance and testing program involving preventive diagnostics may reduce the risk impact even further.

24 POWER TRANSMISSION AND DISTRIBUTION

Refer also to citation(s) 23642

23637 (DOE/PO/10221–T1) **Summary report on the project to develop recommendations on effective linkages between state IRP, facility siting and regional transmission planning in a competitive environment. Final report, May 24, 1994–March 31, 1995.** Western Interstate Energy Board, Denver, CO (United States). [1995]. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-94PO10221. Order Number DE95015456. Source: OSTI; NTIS; GPO Dep.

This project, which began on May 1, 1994, was designed to: improve the understanding of the types of linkages (or lack of linkages) between utility-specific IRP, state facility siting, and regional transmission planning given (1) the current level of competition, (2) increased generation competition, and (3) retail competition; identify opportunities to better coordinate utility-specific IRP and state facility siting with regional transmission planning, including better regional market and transmission planning information for utility-specific plans; and improve the understanding of the influence of competition on utility-specific IRP in terms of planning objectives, planning process, plan implementation and plan output, and identify potential changes to utility-specific IRP to allow IRP to meet planning objectives in a competitive environment.

23638 (ETDE-BR–0002) **An expert system for the identification and quantification of energy interchange modalities.** Albuquerque Junior, Leonel Araujo. Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Informatica. Dec 1988. 141p. (In Portugese). Order Number DE95789946. Source: OSTI; NTIS (US Sales Only).

Many problems related to the energetic operation planning of electric power systems are difficult to solve computationally because they need complex or still unavailable mathematical models or they deal with methodologies that changes frequently. In this document, we try to study one of these problems by the highly experienced professional point of view and to use the expert system technique to develop an efficient tool to solve it. We study the energy interchanges modalities identification and quantification problem of the brazilian electric power system and we describe the expert system developed. (author), 32 refs, 12 tabs

2401 Power Systems

23639 (CONF-9410335–, pp. 230-245) **An architecture for an intelligent automatic generation control for electric power systems.** King, R.L. (Mississippi State Univ., MS (United States)); Luck, R. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

The objective of Automatic Generation Control (AGC) is to dispatch electric power generation to met the load, while constrained by optimum economic operating conditions and the North American Electric Reliability Council (NERC) guidelines. NERC was formed to coordinate the operating practices of the interconnected utilities in North America. The research reported on in this paper defines an architecture for an intelligent AGC that will result in significant cost reductions (short term and long term costs) and improved system efficiency. Significant savings will be realized by improvements in base loading (i.e., less units on automatic generation control), less time operating the system uneconomically (i.e., for a variety of control reasons units are not always operating at their most economical point), and savings in operating and maintenance (O&M) costs (i.e., if more units are based loaded it is anticipated that plant operation will be more efficient). Specifically, this paper addresses issues surrounding the implementation of AGC on a large power system and suggests modifications to this implementation in which intelligent control could have a positive effect. The paper reports on research being conducted to use hybrid systems to monitor the status of a power plant, utilizing intelligent controllers for implementing AGC and dispatching power plants, very short term load forecasting (several minutes look ahead), and developing models of power plants to study degradation of plant performance as an input to AGC.

23640 (CONF-9410335–, pp. 246-257) **Hybrid systems for enhanced process control.** Wildman, D. (Pittsburgh Energy Technology Center, Pittsburg, PA (United States)); Ekmann, J. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

In this study, a probe is positioned in the mixing zone of two air streams. The goal is to maintain the probe at the location of minimum temperature variation. A neural network was trained to predict this position based on air stream temperatures and flow rates. An expert system calls the network and positions the probe. The position that the neural network predicts is a quantity difficult to measure on-line. Without the information from the neural network, the expert system can not position the probe. With the information, the expert system maintains it at the desired location. This study demonstrates how artificial intelligence could be used to enhance a process control system so that a process functions at a more optimal performance.

23641 (ETDE-BR–0014) **Long range planning in electric power distribution systems.** Silva, Marcos Carneiro da. Universidade Estadual de Campinas, SP (Brazil). Faculdade de Engenharia Eletrica. Aug 1990. 202p. (In Portugese). Order Number DE95789958. Source: OSTI; NTIS (US Sales Only).

A new methodological approach for Electric Energy Distribution Systems Expansion Planning is presented. The problems related to primary and secondary networks are treated in a hierarchical model. In the primary system the aspects of location and sizing of substations as well as feeders routing are considered simultaneously. The model includes fixed costs of new substation and feeders and their expansions. The variable costs of losses receive a quadratic approach. An efficient Branch and Bound algorithm is used in problem solving. Network radiality is obtained through heuristic methods, which work under real cost function. On the secondary network, a heuristic procedure was developed which sequentially enumerates transformers and for each one of these configurations it studies in an optimized manner the transformers location, the secondary feeders routing and primary feeders and transformers interconnection. These three phases were modeled respectively as p-medians, quadratic facilities location problem and Steiner's problem. 53 refs, 34 figs, 20 tabs

23642 (ETDE-BR–0024) **Dynamic preventive control in electric power systems.** Minussi, Carlos Roberto. Santa Catarina Univ., Florianopolis, SC (Brazil). Programa de Pos-graduacao em Engenharia Eletrica. Nov 1990. 180p. (In Portugese). Order Number DE95789968. Source: OSTI; NTIS (US Sales Only).

This work presents a methodology for Preventive Control in Electric Power Systems, considering the transient stability and three-phases fault. The transient stability assessment is performed by the PEBS (Power Energy Boundary Surface) method, because this method presents many advantages such as: structure-preserving dynamic model, reduced calculation time and accuracy comparable to numerical simulations. The preventive control method is developed by sensitivity analysis, using the security margin concept. In this way, an incremental model between the security margin change and the pre-fault angular position of the synchronous machines relative to inertial center is determined. The use of this model allows the development of several control alternatives, e.g., by generation re scheduling, load shedding, system topological change, etc, being necessary only to use appropriate transformations. In this work we define a procedure to estimate the generation re scheduling such that the transient stability effect is minimized to levels considered secure. The generation re scheduling is determined by minimizing the change of the generation nominal state. The application results of the proposed method are presented considering two test systems, composed of 10 and 20 synchronous machines based on the southern Brazil system configuration and the IEEE 118 bus system. 51 refs, 22 tabs, 11 figs

23643 (ETDE-BR–0025) **Long term planning for expansion of electric energy transmission systems with restriction of transient stability using the concept of potential energy boundary surface.** Mano, Aldo Mario. Santa Catarina Univ., Florianopolis, SC (Brazil). Programa de Pos-graduacao em Engenharia Eletrica. Jun 1988. 128p. (In Portugese). Order Number DE95789969. Source: OSTI; NTIS (US Sales Only).

This work is concerned with long term planning of electric energy transmission networks. It makes use of graph-searching technique to obtain an alternative and an expansion program, considering the evaluation of the transient stability in the security analysis. A long term planning searches to analyse the transmission system alternatives, to assure the supply market requirements, in a horizon up to 20 years. The transient stability analysis is used in the security evaluation using the PEBS where the contingencies considered are transmission line or transformers outages and short circuits eliminated through transmission line disconnection. More realistic results are obtained with this criterion. For the expansion problem solution, a search algorithm with heuristics is used, where suboptimal or optimal solutions can be found in a specific time. The method is applied to three test systems and results are compared with techniques that use another security evaluation methods. 30 refs, 26 tabs, 9 figs

2402 Power System Networks, Transmission and Distribution

Refer also to citation(s) 23638

23644 (CONF-941089–Vol.1, pp. 271-283) **Overview of U.S. electric utilities: Transmission and distribution systems.** Brown, R.D. (East Kentucky Power Cooperative, Inc., Winchester, KY (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

I hope this brief description of the US electric utility industry has been interesting and informative. No doubt many characteristics, concerns, and research efforts mirror those of the electric utility industry in South Korea. It is hoped that through workshops such as this that electric utilities, manufacturers and consultants may learn from each other for the mutual benefit of all.

23645 (CONF-941089–Vol.1, pp. 285-291) **Present status and forecast of T&D facilities.** Ko, In-Suk. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Before the end of the 1970s, because of our marvelous economic growth and industrial development we had made our best efforts to develop more power sources. But from the 1980s, KEPCO has invested for T&D facility of high quality and improved system reliability. The main considerations for T&D expansion are positive investment to improve facilities of the electric company, improvement of the quality of electrical equipment during manufacturing, and bettering the field construction of power facilities. In order to achieve the ultimate goal of supplying high quality electricity, we will try to improve cooperation between our domestic industries, and research institutes, and increase the exchange of international technology.

23646 (CONF-941089–Vol.1, pp. 293-311) **Intelligent devices simplify remote SCADA installations in substations.** Kopriva, V.J. (Gilbert/Commonwealth, Inc., Reading, PA (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Utilities are increasingly relying on Supervisory Control and Data Acquisition (SCADA) Systems for the effective and economical management of electric transmission and distribution systems. Now, advances in equipment and design technologies have created opportunities for an increased level of monitoring and control at electric power substations. In the past, prohibitive factors, including complicated equipment and wiring retrofits, protocol compatibility, and hardware installation and maintenance costs have impeded electric utilities in their attempt at broad based application of SCADA systems in electric substations, particularly at distribution voltage levels. These advances in equipment technologies

have provided utilities with the opportunity to install and operate SCADA systems at lower cost, while providing flexibility for system expansion over longer periods. The development of intelligent microprocessor controlled devices and integrated communications has facilitated the use of a distributed design approach to installing SCADA monitoring and control in substations. This approach offers greater hardware flexibility and reduced installation costs while increasing reliability, making the addition of monitoring and control to electric substations increasingly practical. This paper will examine current trends in the application of intelligent microprocessor controlled and electronic devices, in stand alone and distributed applications, and the simplification of techniques for installing SCADA systems in substations. It will also consider the potential advantages to be realized in cost and reliability, and examine the necessary changes in design and operation philosophies required to effectively implement the new technology.

23647 (CONF-941089–Vol.1, pp. 313-314) **Fisher Pierce products for improving distribution system reliability.** USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

The challenges facing the electric power utility today in the 1990s has changed significantly from those of even 10 years ago. The proliferation of automation and the personnel computer have heightened the requirements and demands put on the electric distribution system. Today's customers, fighting to compete in a world market, demand quality, uninterrupted power service. Privatization and the concept of unregulated competition require utilities to streamline to minimize system support costs and optimize power delivery efficiency. Fisher Pierce, serving the electric utility industry for over 50 years, offers a line of products to assist utilities in meeting these challenges. The Fisher Pierce Family of products provide tools for the electric utility to exceed customer service demands. A full line of fault indicating devices are offered to expedite system power restoration both locally and in conjunction with SCADA systems. Fisher Pierce is the largest supplier of roadway lighting controls, manufacturing on a 6 million dollar automated line assuring the highest quality in the world. The distribution system capacitor control line offers intelligent local or radio linked switching control to maintain system voltage and Var levels for quality and cost efficient power delivery under varying customer loads. Additional products, designed to authenticate revenue metering calibration and verify on sight metering service wiring, help optimize the profitability of the utility assuring continuous system service improvements for their customers.

23648 (CONF-941089–Vol.1, pp. 315-333) **A microprocessor-based digital feeder monitor with high-impedance fault detection.** Patterson, R. (GE Protection and Control, Malvern, PA (United States)); Tyska, W.; Russell, B.D. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

The high impedance fault detection technology developed at Texas A&M University after more than a decade of research, funded in large part by the Electric Power Research Institute, has been incorporated into a comprehensive monitoring device for overhead distribution feeders. This digital feeder monitor (DFM) uses a high waveform sampling rate for the ac current and voltage inputs in conjunction with a high-performance reduced instruction set (RISC) microprocessor to obtain the frequency response required for arcing fault detection and power quality measurements. Expert system techniques are employed to assure security while maintaining dependability. The DFM is intended to be applied at a distribution substation to monitor one feeder. The DFM is packaged in a non-drawout case which fits the panel cutout for a GE IAC overcurrent relay to facilitate retrofits at the majority of sites were electromechanical overcurrent relays already exist.

23649 (CONF-941089–Vol.1, pp. 335-371) **World-wide distribution automation systems.** Devaney, T.M. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

A worldwide power distribution automation system is outlined. Distribution automation is defined and the status of utility automation is discussed. Other topics discussed include a distribution management system, substation feeder, and customer functions, potential benefits, automation costs, planning and engineering considerations, automation trends, databases, system operation, computer modeling of system, and distribution management systems.

23650 (CONF-941089–Vol.1, pp. 373-400) **Amorphous metal distribution transformers: The energy-efficient alternative.** Garrity, T.F. (GE Power Systems, Schenectady, NY (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Amorphous metal distribution transformers have been commercially available for the past 13 years. During that time, they have realized the promise of exceptionally high core efficiency as compared to silicon steel transformer cores. Utility planners today must consider all options available to meet the requirements of load growth. While additional generation capacity will be added, many demand-side initiatives are being undertaken as complementary programs to generation expansion. The efficiency improvement provided by amorphous metal distribution transformers deserves to be among the demand-side options. The key to understanding the positive impact of amorphous metal transformer efficiency is to consider the aggregate contribution those transformers can make towards demand reduction. It is estimated that distribution transformer core losses comprise at least 1% of the utility's peak demand. Because core losses are continuous, any significant reduction in their magnitude is of great significance to the planner. This paper describes the system-wide economic contributions amorphous metal distribution transformers can make to a utility and suggests evaluation techniques that can be used. As a conservation tool, the amorphous metal transformer contributes to reduced power plant emissions. Calibration of those emissions reductions is also discussed in the paper.

23651 (CONF-941089–Vol.1, pp. 401-423) **Distributed generation systems model.** Barklund, C.R. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

A slide presentation is given on a distributed generation systems model developed at the Idaho National Engineering Laboratory, and its application to a situation within the Idaho Power Company's service territory. The objectives of the work were to develop a screening model for distributed generation alternatives, to develop a better understanding of distributed generation as a utility resource, and to further INEL's understanding of utility concerns in implementing technological change.

23652 (CONF-941089–Vol.1, pp. 425-439) **Current trends in the application of non-ceramic insulators for transmission & distribution lines subject to contamination.** Riordan, K.C. (Reliable Power Products, Franklin Park, IL (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Non-Ceramic Insulators (NCI) have been in application for more than 25 years. During this time, manufacturers have worked diligently to improve product designs and polymer materials. Today, the use of Non-Ceramic Polymer insulators is proliferating as Utilities become more confident in this advanced technology. The application advantages of NCI technology are more widely recognized and understood and credibility is growing in the long term service performance of these insulators. Current estimates place the NCI market share as high as 50% of the total US transmission insulator market. Indeed, Reliable Power Products is proud to advise that their insulators have been selected for the first 500 KV-DC transmission line in the USA to use 100% composite polymer insulators. With the combination of Los Angeles Department of Water and Power (Los Angeles to Las Vegas) and Salt River Project (Las Vegas to Phoenix), a total of almost 1,000 Kms. of transmission line will be insulated with Silicone Rubber Polymer Insulators. The total project will include almost 15,000 insulator strings. User confidence is not confined to the USA market. The application of NCI's by International Utilities has also experienced significant growth. This may be evidenced by EHV installations in South America, Middle East, South Africa, Australia and South East Asia.

23653 (CONF-941089–Vol.1, pp. 441-464) **Energy conservation in electric distribution.** Lee, Chong-Jin. USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

This paper discusses the potential for energy and power savings that exist in electric power delivery systems. These savings translate into significant financial and environmental benefits for electricity producers and consumers as well as for society in general. AlliedSignal's knowledge and perspectives on this topic are the result of discussions with hundreds of utility executives, government officials and other industry experts over the past decade in conjunction with marketing our Amorphous Metal technology for electric distribution transformers. Amorphous metal is a technology developed by AlliedSignal that significantly reduces the energy lost in electric distribution transformers at an incremental cost of just a few cents per kilo-Watt-hour. The purpose of this paper is to discuss: Amorphous Metal Alloy Technology; Energy Savings Opportunity; The Industrial Barriers and Remedies; Worldwide Demand; and A Low Risk Strategy. I wish this presentation will help KEPCO achieve their stated aims of ensuring sound development of the national economy and enhancement of public life through the economic and stable supply of electric power. AlliedSignal Korea Ltd. in conjunction with AlliedSignal Amorphous Metals in the U.S. are here to work with KEPCO, transformer manufacturers, industry, and government agencies to achieve greater efficiency in power distribution.

23654 (DOE/AL/82993–9) **The value of distributed generation: The PVUSA grid-support project serving Kerman Substation. Interim report, April 1994.** Hoff, T. (Pacific Energy Group (United States)); Wenger, H. Pacific Gas and Electric Co., San Ramon, CA (United States). Dept. of Research and Development; Pacific Energy Group (United States). Jul 1994. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-92AL82993. Order Number DE95013803. Source: OSTI; NTIS; GPO Dep.

A common practice of electric utilities experiencing transmission and distribution (T and D) system overloads is to expand the substation, add lines, or upgrade equipment, all of which are capital intensive options. In 1988, it was hypothesized that strategically sited photovoltaics (PV) could benefit parts of T and D systems near or at overloaded conditions. An evaluation methodology was developed and applied to a test case (Kerman Substation near Fresno, California). Analytical results suggested that the value of PV to the T and D system could substantially exceed its energy and generation capacity value. The importance of this finding indicated the need for empirical validation. This led to the construction of a 0.5 MW PV demonstration plant by Pacific Gas and Electric Company (PG and E) at Kerman, California as part of the PVUSA (PV for Utility Scale Applications) project. PVUSA is a national public-private partnership that is assessing and demonstrating the viability of utility-scale photovoltaic electric generation systems. The Kerman PV plant, commissioned for commercial operation in June, 1993, is reported to be the first grid-support PV demonstration plant in the world. This Interim Report focuses on validating the technical aspects of grid-support PV. It provides interim validation results for four of the eight identified value components that stack up to make the "value bar", and compares them to 1992 Case Study estimates. Results are based on improved technical evaluation methodologies, measured plant performance under a variety of conditions, and long-term plant performance estimated using a validated computer simulation program. This report is not intended to be exhaustive in scope. It does, however, provide a thorough progress update of the validation project. Complete documentation of test procedures, data, and evaluation methods will be presented in the Final Report.

23655 (DOE/OR/21999–T2) **Refurbish power supply/distribution system Phase II. Progress status report No. 43, March 1, 1995–March 31, 1995.** Hayes, Seay, Mattern and Mattern, Roanoke, VA (United States). 31 Mar 1995. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21999. Order Number DE95014990. Source: OSTI; NTIS; GPO Dep.

This is a progress report detailing the schedules, accomplishments, and contract changes in the refurbishment of the Oak Ridge Y-12 plant power supply and distribution system.

23656 (ETDE-BR–0022) **Hierarchical state estimation for interconnected electric power systems: a comparative analysis.** Silva Gouvea, Jose Paulo da. Santa Catarina Univ., Florianopolis, SC (Brazil). Programa de Pos-graduacao em Engenharia Eletrica. Aug 1990. 151p. (In Portugese). Order Number DE95789966. Source: OSTI; NTIS (US Sales Only).

This work is a comparative study of three hierarchical state estimation algorithms for interconnected electric power systems. The algorithms related were proposed in the literature and consider the electric system made up of various subsystems coordinated by an Energy Control Center. All three algorithms work with two hierarchical levels. The first is the local level and is related to the state estimation of the individual subsystems. The second is the coordination level, and is related to the estimation of the phase angles among the slack busses of the individual subsystems. The objective of this work is to determine the characteristics of each algorithm, assessing its applicability to the state estimation of interconnected power systems. Aspects such as information interchanges among the subsystems and the coordination level and vice-verse, storage requirements, execution time, accuracy, reliability and bad data processing are also analyzed. Comparisons are made between the results obtained by hierarchical estimators against the results obtained by a classical integrated estimator. The performance of each algorithm is tested using two electric power systems. The first test system is the IEEE-30 bus network. The second one is a realistic system derived from the 230 kV/500 kV interconnected network of the south-southeast region of Brazil. (author). 28 refs, 9 figs, 31 tabs

23657 (ORNL–6804/R1) **The feasibility of replacing or upgrading utility distribution transformers during routine maintenance.** Barnes, P.R.; Van Dyke, J.W.; McConnell, B.W.; Cohn, S.M.; Purucker, S.L. Oak Ridge National Lab., TN (United States). Apr 1995. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013967. Source: OSTI; NTIS; GPO Dep.

It is estimated that electric utilities use about 40 million distribution transformers in supplying electricity to customers in the United States. Although utility distribution transformers collectively have a high average efficiency, they account for approximately 61 billion kWh of the 229 billion kWh of energy lost annually in the delivery of electricity. Distribution transformers are being replaced over time by new, more efficient, lower-loss units during routine utility maintenance of power distribution systems. Maintenance is typically not performed on units in service. However, units removed from service with appreciable remaining life are often refurbished and returned to stock. Distribution transformers may be removed from

service for many reasons, including failure, over- or underloading, or line upgrades such as voltage changes or rerouting. When distribution transformers are removed from service, a decision must be made whether to dispose of the transformer and purchase a lower-loss replacement or to refurbish the transformer and return it to stock for future use. This report contains findings and recommendations on replacing utility distribution transformers during routine maintenance, which is required by section 124(c) of the Energy Policy Act of 1992. The objectives of the study are to evaluate the practicability, cost-effectiveness, and potential energy savings of replacing or upgrading existing transformers during routine utility maintenance and to develop recommendations on was to achieve the potential energy savings.

23658 (PNL-SA–25889) **High-temperature superconducting transformer evaluation.** DeSteese, J.G.; Dagle, J.E.; Dirks, J.A. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950414–7: 57. annual American power conference, Chicago, IL (United States), 18-20 Apr 1995). Order Number DE95014192. Source: OSTI; NTIS; GPO Dep.

The advancing development of high-temperature superconducting (HTS) materials is encouraging the evaluation of many practical applications. This paper summarizes a study that examined the future potential of HTS power transformers in the 30-MVA to 1000-MVA capacity range. Transformer performance was characterized on the basis of potentially achievable HTS materials capabilities and dominant transformer design parameters. Life-cycle costs were estimated and compared with those of conventional transformers to evaluate the economic viability and market potential of HTS designs. HTS transformers are projected to have both capital and energy cost advantages attributable to their ability to be intrinsically smaller and lighter than conventional transformers of comparable capacity.

23659 (USGS-OFR–94-638) **Stability of submerged slopes on the flanks of the Hawaiian Islands, a simplified approach.** Lee, H.J.; Torresan, M.E.; McArthur, W. Geological Survey, Menlo Park, CA (United States). 1994. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-93OR22089. Order Number DE95013086. Source: OSTI; NTIS; GPO Dep.

Undersea transmission lines and shoreline AC-DC conversion stations and near-shore transmission lines are being considered as part of a system for transporting energy between the Hawaiian Islands. These facilities will need to be designed so that they will not be damaged or destroyed by coastal or undersea landslides. Advanced site surveys and engineering design of these facilities will require detailed site specific analyses, including sediment sampling and laboratory testing of samples, in situ testing of sediment and rock, detailed charting of bathymetry, and two- or three-dimensional numerical analyses of the factors of safety of the slopes against failure from the various possible loading mechanisms. An intermediate approximate approach can be followed that involves gravity and piston cores, laboratory testing and the application of simplified models to determine a seismic angle of repose for actual sediment in the vicinity of the planned facility. An even simpler and more approximate approach involves predictions of angles of repose using classification of the sediment along a proposed route as either a coarse volcaniclastic sand, a calcareous ooze, or a muddy terrigenous sediment. The steepest slope that such a sediment can maintain is the static angle of repose. Sediment may be found on slopes as steep as these, but it must be considered metastable and liable to fail in the event of any disturbance, storm or earthquake. The seismic angle of repose likely governs most slopes on the Hawaiian Ridge. This declivity corresponds to the response of the slope to a continuing seismic environment. As a long history of earthquakes affects the slopes, they gradually flatten to this level. Slopes that exceed or roughly equal this value can be considered at risk to fail during future earthquakes. Seismic and static angles of repose for three sediment types are tabulated in this report.

2403 Power Transmission Lines and Cables

23660 (CONF-941089–Vol.2, pp. 860-898) **Bulk power system performance issues affecting utility peaking capacity additions.** Garrity, T.F. (GE Power Sytems, Schenectady, NY (United States)). USDOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 2.* 607p. Order Number DE95011613. Source: OSTI; NTIS; GPO Dep.

This paper presents a discussion of transmission system constraints and problems that affect the siting and rating of peaking capacity additions. Techniques for addressing and modifying these concerns are presented. Particular attention is paid to techniques that have been successfully used by utilities to improve power transfer and system loadability, while avoiding the construction of additional transmission lines. Proven techniques for dealing with thermal, short-circuit level and stability issues are presented.

2404 Health and Safety

Refer also to citation(s) 23663, 24739

23661 (UCRL-ID–120543) **LLNL Electrical Safety Committee Summary report for 1993 and 1994.** Niven, W.A.; Trost, S.R. Lawrence Livermore National Lab., CA (United States). Mar 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011518. Source: OSTI; NTIS; GPO Dep.

The ESC is presently organized with three subcommittees: Guidelines and Regulations, Programs and Training, and Performance Measurement and Analysis. Current membership is attached for information, as well as the charters of the three subcommittees. The committee at large meets once a quarter, the Executive Committee, comprised of the Committee Chair, the Executive Secretary and the Subcommittee Chairs meets twice quarterly, and the subcommittees meet once or twice per month. Minutes of meetings are distributed to the ES&H Working Group and senior Laboratory management.

2405 Environmental Aspects

Refer also to citation(s) 23637, 23696

23662 (DOE/EIS–0173-FINAL) **BPA/Puget Power Northwest Washington Transmission Project. Final Environmental Impact Statement.** USDOE Bonneville Power Administration, Portland, OR (United States); Whatcom, County of, WA (United States). Aug 1995. 238p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016113. Source: OSTI; NTIS; GPO Dep.

BPA and Puget Sound Power & Light propose to upgrade existing high-voltage transmission system in the Whatcom and Skagit counties between the towns Custer and Sedro Woolley, including some land in Bellingham. The upgrades are needed to increase the transmission capacity on a nearby US-Canada 500kV intertie by about 850 MW. A Draft EIS was issued Nov. 1993. A supplemental DEIS was issued April 1995. The EIS was finalized by showing changes on insert sheets and attaching them to the supplemental DEIS. These changes together with the Supplemental DEIS form the Final EIS. The EIS has identified impacts that would generally be classified as low to moderate and localized. Effects on soils and water resources in sensitive areas (e.g., near Lake Whatcom) would be low to moderate; there would be either increases, decreases or no change in magnetic fields, depending on design and location; noise levels would remain at existing levels; and land use and property value impacts would be either short term or low. Threatened and endangered species would not be adversely affected. Visual impacts would be low to moderate; socioeconomic and cultural impacts would be low to moderate. The proposed action would allow BPA to use its part of the transmission capability increase to displace other generating resources in USA, when stored energy is returned from Canada.

23663 (PNL-SA–25190) **The framework and tools for the Western Area Power Administration's Environmental Risk Management Program.** Di Massa, F.V. (Pacific Northwest Lab., Richland, WA (United States)); Glantz, C.S.; Roybal, A.L. Pacific

Northwest Lab., Richland, WA (United States). Jun 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9506115–4: 20. National Association of Environmental Professionals annual conference and exposition: environmental challenges - the next twenty years, Washington, DC (United States), 10-13 Jun 1995). Order Number DE95014187. Source: OSTI; NTIS; GPO Dep.

Pacific Northwest Laboratory (PNL) is working with various government agencies to develop and implement environmental risk management programs. One such program is being developed for the U.S. Department of Energy's Western Area Power Administration (Western). In this paper, we describe the risk framework and assessment tools being developed by Western and PNL to help Western's management staff make effective and defensible decisions on issues that involve environmental risk.

2406 Legislation and Regulations

Refer also to citation(s) 23637, 23727

2407 Economic, Industrial, and Business Aspects

Refer also to citation(s) 23646, 23647, 23648, 23649, 23650, 23651, 23652, 23653, 23657, 23658

25 ENERGY STORAGE

23664 (SAND–95-8247) **The emerging roles of energy storage in a competitive power market: Summary of a DOE Workshop.** Gordon, S.P.; Falcone, P.K. (eds.). Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941274–Summ.: Emerging roles of energy storage in a competitive power market, Pleasanton, CA (United States), 6-7 Dec 1994). Order Number DE95014489. Source: OSTI; NTIS; GPO Dep.

This report contains a summary of the workshop, "The Emerging Roles of Energy Storage in a Competitive Power Market," which was sponsored by the U.S. Department of Energy and Sandia National Laboratories and was held in Pleasanton, California on December 6-7, 1994. More than 70 people attended, representing government agencies, national laboratories, equipment vendors, electric utilities and other energy providers, venture capital interests, and consultants. Many types of energy storage were discussed, including electrical (batteries and superconducting magnets), mechanical (flywheels and pumped hydro), hydrogen, compressed air, and thermal energy storage. The objectives of the workshop were to communicate within the energy storage community regarding the costs, benefits, and technical status of various technology options; to explore and elucidate the evolving roles of energy storage in a more dynamic and competitive power and energy marketplace; and to discuss the optimum federal role in this area. The goals of the workshop were fully realized through knowledgeable and insightful presentations and vigorous discussion, which are summarized.

2501 Magnetic

23665 (ANL/ET/CP–84772) **High-temperature superconductor current leads for electric utility SMES applications.** Niemann, R.C. (Argonne National Lab., IL (United States)); Cha, Y.S.; Hull, J.R.; Buckles, W.E.; Weber, B.R.; Dixon, K.D.; Rey, C.M. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950729–9: 30. Intersociety energy conversion conference, Orlando, FL (United States), 30 Jul - 5 aug 1995). Order Number DE95014223. Source: OSTI; NTIS; GPO Dep.

Current leads that utilize high-temperature superconductors (HTSS) to deliver power to devices operating at liquid helium temperature have the potential to reduce refrigeration requirements to levels significantly below those achievable with conventional leads. As part of the US Department of Energy's Superconductivity Technology Program, Argonne National Laboratory and two industrial partners are developing HTS current leads for application to superconducting magnetic energy storage (SMES) systems. Superconductivity, Inc. (SI) is a supplier of micro-SMES systems for power-quality applications. A typical SI SMES system has an 0.3-kWh energy capacity and operates at currents up to 1.2 k.A. The Babcock & Wilcox Company (B&W) is engaged in a project to design, build, and demonstrate a midsized SMES system. The B&W system has an 0.5-MWh energy capacity and operates at currents up to 16 kA. Details of the lead designs. including materials, configuration and performance predictions. are presented.

2506 Thermal

Refer also to citation(s) 23755

2509 Batteries

Refer also to citation(s) 23507, 23811, 23812, 23816

23666 (CRIE-T–93079) **Trend in research of lithium conductive solid electrolyte.** Kobayashi, A. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Takei, K.; Miyashiro, T.; Iwahori, T. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Jun 1994. 40p. (In Japanese). Order Number DE95790573. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

In reference to a solid electrolyte for lithium secondary batteries, a survey was made on the trend in domestic and overseas researches, searching for electrolyte systems that seemed promising. Solid electrolytes are stable at a high temperature, easy for a compact lamination, and hopeful of the enhancement of energy density. A high polymer type solid electrolyte has the operating temperature of approximately 100°C and is unable to provide a satisfactory performance at room temperature. Moreover, its cation transference number is small, and an increase in resistance is feared at the time of charge/discharge of anion moving. An inorganic type has a high cation transference number and has a potential for the enhancement in conductivity through the control of the crystal structure and vitrified state. However, the inorganic type presents difficulty in making a large area and the lack of stability with lithium metal, leaving a number of problems for the practical use. A composite type is such that a high polymer network is provided with an inorganic conductive mechanism. It has a good potential in the enhancement in conductivity, capability of making a thin film and that of making a large area as well as having a high cation transference number, all of which contribute to the bright future in spite of a number of unknown points. 57 refs., 27 figs., 6 tabs.

23667 (DOE/ER/14379–T1) **Nickel-metal hydride battery development. Final technical report.** Electro Energy, Inc., Danbury, CT (United States). Jun 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-93ER14379. Order Number DE95015502. Source: OSTI; NTIS; GPO Dep.

Rechargeable batteries are used as the power source for a broad range of portable equipment. Key battery selection criteria typically are weight, volume, first cost, life cycle cost, and environmental impact. Rechargeable batteries are favored from a life cycle cost and environmental impact standpoint over primary batteries. The nickel-metal hydride (Ni-MH) battery system has emerged as the battery of choice for many applications based on its superior characteristics when judged on the above criteria against other battery types. In most cases commercial Ni-MH batteries are constructed with coiled electrodes in cylindrical metal containers. Electro Energy, Inc. (EEI) has been developing a novel flat bipolar configuration of the Ni-MH system that offers weight, volume, and cost advantages when compared to cylindrical cells. The unique bipolar approach consists of fabricating individual flat wafer cells in conductive, carbon-filled, plastic face plates. The individual cells contain a nonconductive plastic border which is heat sealed around the perimeter to make a totally sealed unit cell. Multi-cell batteries are fabricated by stacking the individual wafer cells in such a way that the positive face of one cell contacts the negative face of the

adjacent cell. The stack is then contained in an outer housing with end contacts. The purpose of this program was to develop, evaluate, and demonstrate the capabilities of the EEI Ni-MH battery system for consumer applications. The work was directed at the development and evaluation of the compact bipolar construction for its potential advantages of high power and energy density. Experimental investigations were performed on various nickel electrode types, hydride electrode formulations, and alternate separator materials. Studies were also directed at evaluating various oxygen recombination techniques for low pressure operation during charge and overcharge.

23668 (SAND–90-2318) **Deformation study of separator pellets for thermal batteries.** Guidotti, R.A.; Reinhardt, F.W.; Thomas, E.V. Sandia National Labs., Albuquerque, NM (United States). May 1995. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013871. Source: OSTI; NTIS; GPO Dep.

The deformation characteristics of pellets of electrolyte-binder (EB) mixes based on MgO were measured under simulated, thermal-battery conditions. Measurements (using a statistically designed experimental strategy) were made as a function of applied pressure, temperature, and percentage of theoretical density for four molten-salt electrolytes at two levels of MgO. The EB mixes are used as separators in Li-alloy thermal batteries. The electrolytes included LiCl-KCl eutectic, LiCl-LiBr-KBr eutectic, LiBr-KBr-LiF eutectic, and a LiCl-LiBr-LiF electrolyte with a minimum-melting composition. The melting points ranged from 313 C to 436 C. The experimental data were used to develop statistical models that approximate the deformation behavior of pellets of the various EB mixes over the range of experimental conditions we examined. This report, discusses the importance of the deformation response surfaces to thermal-battery design.

23669 (SAND–95-1313C) **Thermal batteries: A technology review and future directions.** Guidotti, R.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951033–3: 27. international technical conference of the Society for the Advancement of Material and Process Engineering: diversity into the next century, Albuquerque, NM (United States), 9-12 Oct 1995). Order Number DE95014859. Source: OSTI; NTIS; GPO Dep.

Thermally activated ("thermal") batteries have been used for ordnance applications (e.g., proximity fuzes) since World War II and, subsequent to that, in nuclear weapons. This technology was developed by the Germans as a power source for their V2 rockets. It was obtained by the Allies by interrogation of captured German scientists after the war. The technology developed rapidly from the initial primitive systems used by the Germans to one based on Ca/$CaCrO_4$. This system was used very successfully into the late 1970s, when it was replaced by the Li-alloy/FeS_2 electrochemical system. This paper describes the predominant electrochemical couples that have been used in thermal batteries over the years. Major emphasis is placed on the chemistry and electrochemistry of the Ca/$CaCrO_4$ and Li-alloy/FeS_2 systems. The reason for this is to give the reader a better appreciation for the advances in thermal-battery technology for which these two systems are directly responsible. Improvements to date in the current Li-alloy/FeS_2 and related systems are discussed and areas for possible future research and development involving anodes, cathodes, electrolytes, and insulations are outlined. New areas where thermal-battery technology has potential applications are also examined.

29 ENERGY PLANNING AND POLICY

Refer also to citation(s) 25024

2901 Energy Analysis and Modeling

23670 (ETDE-DE–137) **Climate-compatible energy supply in Baden-Wuerttemberg. Industry and small-scale consumers with high process energy consumption.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 9. Jochem, E. (Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany)); Bradke, H.; Mannsbart, W.; Oetjen, H. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 121p. (In German). Order Number DE95790279. Source: OSTI; NTIS (US Sales Only).

In the context of a "Technical Guide for Climate-Compatible Energy Supply" for Baden-Wuerttemberg, potential energy savings are to be investigated, including the investment cost and measures required for achieving energy savings in the different consumption sectors. This report analyzes the industrial sector and those sectors of small-scale consumers (agriculture/horticulture, trade, small-scale industries, building industry) where process energy consumption is high. The potentials of combined heat and power generation are discussed.

23671 (ETDE-DE–139) **Climate-compatible energy supply in Baden-Wuerttemberg. Demand scenario.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 6. Bonhoff, C. (Stuttgart Univ. (Germany). Inst. fuer Energiewirtschaft und Rationelle Energieanwendung (IER)); Fahe, U.; Voss, A. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 80p. (In German). Order Number DE95790286. Source: OSTI; NTIS (US Sales Only).

This report comprises three parts: In the first part, the global background data for a projection of exogenic determinant factors relevant for the development of energy supply in BAden-Wuerttemberg are described. On this basis, the second part presents a finer structure of the background data, while the third part defines the indicators which determine energy consumption. Consumer groups and energy uses are differentiated.

23672 (ETDE-DE–140) **Climate-compatible energy supply in Baden-Wuerttemberg - Least-cost planning for the household and small-scale consumption sector in Baden-Wuerttemberg.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 23. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany); Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft GmbH und Co. KG, Stuttgart (Germany). Jun 1994. 88p. (In German). Order Number DE95790269. Source: OSTI; NTIS (US Sales Only).

The concept of least-cost planning and its theoretical background are explained. After this, the report investigates whether the LCP approach, which originated in the USA, can be applied in the legal and structural conditions of power supply in Baden-Wuerttemberg. LCP programmes and measures carried out in Baden-Wuerttemberg until now are analyzed, and the potential savings in electric power are estimated and discussed. Obstacles to the LCP strategy and problems connected with it are pointed out, and possible solutions are presented. Finally, conclusions are drawn and recommendations made.

2902 Economics and Sociology

Refer also to citation(s) 23412, 23644, 23645, 23727, 23748, 23986, 24412, 24449, 24576, 24682, 24738

23673 (BNL–61702) **Local alliance building for urban science education.** Brookhaven National Lab., Upton, NY (United States). Sep 1994. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9408239–Summ.: Local alliance building for urban science education (Lab for use), Upton, NY (United States), 7-9 Aug 1994). Order Number DE95013512. Source: OSTI; NTIS; GPO Dep.

Leaders from nationally recognized sponsors of teacher education partnerships, the US DOE, university leaders, the New York State Department of Education and past and present teacher researchers gathered at Brookhaven National Laboratory in August 1994. Their mission was (1) to consider the unique aspects that research experiences provide for teachers and their students and (2) to discuss the value of systemic changes to the teacher preparation process to include such experiences. Presentations by participants and small-group discussion sessions led to an action plan and recommendations for disseminating materials addressing these issues

nationally. Concluding remarks labeled the issues discussed as critical to the systemic change in the teacher preparation process. By sharing this document, additional interest and feedback will be generated, as will commitments to this philosophy.

23674 (CONF-9302211–Summ.) **Science must put its house in order, ethics forum participants conclude.** Sigma Xi, the Scientific Research Society, Inc., Durham, NC (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-93ER75860. From Ethics, values and the promise of science: a forum on science and ethics; San Francisco, CA (United States); 25-26 Feb 1993. Order Number DE95011230. Source: OSTI; NTIS; GPO Dep.

Short communication. ETHICAL ASPECTS/meetings; SCIENTIFIC PERSONNEL/ethical aspects; MEETINGS; RECOMMENDATIONS; PUBLIC OPINION

23675 (CONF-9410353–Exc.) **Sharing our successes II: Changing the face of science and mathematics education through teacher-focused partnerships.** United States Export Council for Renewable Energy, Washington, DC (United States). [1995]. 100p. Sponsored by USDOE, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract FG02-94ER76002. From 2. sharing our successes conference on changing the face of science and mathematics education through teacher-focused partnerships; Berkeley, CA (United States); 12-14 Oct 1994. Order Number DE95014714. Source: OSTI; NTIS; GPO Dep.

Industry Initiatives for Science and Math Education (IISME) in the San Francisco Bay Area planned and convened the second national conference for representatives of scientific work experience programs for K-12 teachers (SWEPs) at Lawrence Hall of Science, University of California at Berkeley October 13-14, 1994. The goal of this conference was to further strengthen the growing community of SWEP managers and teacher participants by providing an opportunity for sharing expertise and strategies about the following: (1) How SWEPs can complement and stimulate systemic education reform efforts; (2) Assessment strategies piloted by the ambitious multi-site evaluation project funded by the U.S. Department of Energy (DOE) as well as smaller evaluation projects piloted by other SWEPs; (3) Expanding and strengthening the base of teachers served by SWEPs; (4) Ensuring that SWEPs adequately support teachers in affecting classroom transfer and offer "more than just a summerjob"; (5) Sustaining and expanding new programs. A special teacher strand focused on leadership development supporting teachers to become effective change agents in their classrooms and schools, and developing strong teacher communities.

23676 (CONF-9506115–2) **Incorporating environmental justice into environmental decision making.** Wolfe, A.K. (Oak Ridge National Lab., TN (United States)); Vogt, D.P.; Hwang, Ho-Ling. Oak Ridge National Lab., TN (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 20. National Association of Environmental Professionals annual conference and exposition: environmental challenges - the next twenty years; Washington, DC (United States); 10-13 Jun 1995. Order Number DE95013978. Source: OSTI; NTIS; GPO Dep.

Executive Order 12898, signed on February 11, 1994, broadly states that federal activities, programs, and policies should not produce disproportionately high and adverse impacts on minority and low-income populations. Moreover, the Order indicates that these populations should not be denied the benefits of, or excluded from participation in, these activities, programs, and policies. Because a presidential memorandum accompanying the order said that National Environmental Policy Act (NEPA) documents should begin to address environmental justice immediately, much attention has been paid to assessment-related issues. Also important, a topic that appears to have received relatively little attention, is how decision makers should be expected to use information about environmental justice in their decision making. This paper discusses issues surrounding the use of environmental justice information in the decision-making process by focusing on the following five main topics: (1) the importance, or weight, attached to environmental justice within larger decision-making contexts; (2) the potential tension between localized environmental justice issues and regional or national issues and needs; (3) the use of environmental justice information to develop (perhaps in concert with affected minority and low-income communities) appropriate mitigation strategies, or to establish conditions under which activities, programs, and policies may be accepted locally; (4) the general implications of shifting the distribution of broadly defined risks, costs, and benefits among different population groups; and (5) the implications of implementing environmental justice on an individual, ad hoc basis rather than within a larger environmental justice framework. This paper raises the issues and discusses the implications of alternative approaches to them.

23677 (CONF-9506115–6) **The plethora of publics and their participation in policy making: How can they properly participate?.** Carnes, S.A. Oak Ridge National Lab., TN (United States). [1995]. 19p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From 20. National Association of Environmental Professionals annual conference and exposition: environmental challenges - the next twenty years; Washington, DC (United States); 10-13 Jun 1995. Order Number DE95013981. Source: OSTI; NTIS; GPO Dep.

This paper examines the theoretical bases of publics and stakeholder participation in decision making, with special attention to mixed issues, including federal government actions such as remedial action programs and hazardous facility sitings. Empowerment associated with participation is addressed, focusing on differences between power and authority.

23678 (CR-B–95-05) **Audit of the Federal Energy Regulatory Commission's Office of Chief Accountant.** USDOE Office of Inspector General, Washington, DC (United States). Capital Regional Audit Office. 7 Apr 1995. 18p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI.

The Federal Energy Regulatory Commission's (Commission) mission is to oversee America's natural gas and oil pipeline transportation, electric utility, and hydroelectric power industries to ensure that consumers receive adequate energy supplies at just and reasonable rates. To carry out this mission, the Commission issues regulations covering the accounting, reporting, and rate-making requirements of the regulated utility companies. The Commission's Office of Chief Accountant performs financial related audits at companies to ensure compliance with these regulations. The purpose of this audit was to evaluate the office of Chief Accountant's audit performance. Specifically, the objectives were to determine if the most appropriate audit approach was used and if a quality assurance process was in place to ensure reports were accurate and supported by the working papers.

23679 (CRIE-R–93006) **Estimation of district energy saving potential by introduction of district energy supply systems. 1. Development of district energy saving estimation model.** Sagai, S. (Central Research Institute of Electric Power Industry, Tokyo (Japan)). Central Research Inst. of Electric Power Industry, Tokyo (Japan). Mar 1994. 30p. (In Japanese). Order Number DE95790566. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

Researches were carried out on such matters as energy saving effects through the utilization of unused energy resources and as functions concerning the estimation of restrictive conditions for the piping length in district heat supply, on a model for a district energy saving analysis in the case of the introduction of various cogeneration systems. For the unused energy resources, the objects selected were thermoelectric power stations, transforming stations, sewage-treatment plants, sludge incineration facilities, and waste incineration plants. Their quantities per day were estimated in consideration of the operation pattern at each generating source. These energy resources were classified into those directly usable as hot water/steam and those used through heat pumps, on which models were made. For the estimation of the piping length for heat supply, data were collected on the number of buildings, floor areas and road length in each mesh; and a heat supply quantity per unit piping system was formulated as a model. In the energy saving estimation model, an hourly observation was made on the heat inside

the districts, demand pattern and co-generation for electric power, and the generation of unused heat resources; and a comparison was made with the conventional means. 11 refs., 8 figs., 8 tabs.

23680 (CRIE-R--93017) **Estimation of district energy saving potential by introduction of district energy supply systems. 2. Estimation of district energy saving in the Tokyo area.** Sagai, S. (Central Research Institute of Electric Power Industry, Tokyo (Japan)). Central Research Inst. of Electric Power Industry, Tokyo (Japan). Mar 1994. 29p. (In Japanese). Order Number DE95790564. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

An analysis was made on energy saving by a co-generation arrangement model by using the data of energy demand pattern and the data of urban structure for the area of 23 wards in Tokyo. Energy demand data was inputted in the model for each of about 600 district meshes, and a hypothetical energy supply system was set up in each district mesh so as to fill the demand. Conventional energy supplies as electric power for commercial use and heat source for exclusive use were employed to compare with the energy supply efficiency. Four kinds of co-generation system and three operational patterns were prepared for the model, and the maximum energy saving ratio was automatically selected for each mesh. As the result of the analysis, demand for electricity was high as compared with heat, in the area where demand for energy was high in the central area of Tokyo. It was therefore considered advantageous to select a co-generation having a high generating efficiency. The average energy saving ratio of the entire Tokyo area was turned out approximately 20% by means of co-generation that was fit for the demand characteristic of each district mesh. 11 refs., 17 figs., 5 tabs.

23681 (CRIE-Y--94006) **Demographic forecasting modelling and prediction of Japanese population.** Kato, H. (Central Research Institute of Electric Power Industry, Tokyo (Japan)). Central Research Inst. of Electric Power Industry, Tokyo (Japan). Oct 1994. 38p. (In Japanese). Order Number DE95790544. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

In order to forecast a medium and long-range socio-economic environment, it is essential to precisely grasp the aging of population and the falling trend of fertility rate. For this purpose, a demographic forecasting model was developed which put emphasis on socio-economic aspects, and an estimation was made on the future Japanese population. The fall in the total fertility rate (TFR) has been largely influenced by a declining trend of fertility rate in the cohort of people aged 25 to 29 years. The continuation of such trend would contribute to the fall of TFR to 1.42 in 2010 and as low as 1.38 in 2020. The average span of life will extend to 78.9 years for males and to 85.9 years for females in 2020. As a result, the population will reach a peak of 127,020,000 in 2006 and then decline. It will move to 121,338,000 in 2020; and earlier in 2019, it will be lower than the level of 1990. The number of births will increase slightly from now because the second baby-boom generations reach childbearing age; but it will decrease again after 2001 and will fall below one million in 2015. The future population of people aged 65 years and over will increase from 12.1% in 1990 to 20.5% in 2015, and will reach 26.6% in 2020. 12 refs., 10 figs., 10 tabs.

23682 (DOE/OR/00033--T655) **Manpower assessment brief: June 1995, No. 29.** Oak Ridge Inst. for Science and Education, TN (United States). 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE95015626. Source: OSTI; NTIS; GPO Dep.

This document provides in verbal and graphical form projection of employment of scientists and engineers within the US Department of Energy for 1994-2000.

23683 (PNL-SA--26327) **Why so few young women in mathematics, science, and technology classes?** Wieda, K.J. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9506214--1: Women in technology conference, Woodbury, NY (United States), 17-18 Jun 1995). Order Number DE95014630. Source: OSTI; NTIS; GPO Dep.

Many factors influence the success of women in scientific and technical careers. Women represent over 50% of the U.S. population, yet less than 16% of women are employed in scientific and technical careers. Research over the last decade makes it clear that disparities exist in the participation, achievement, and attitudes of young men and young women in science classes. Young women are as interested in science experiences as young men up until age nine. After that age, the number of young women interested in science, mathematics, and technology classes drops. Not enrolling in science and mathematics classes in high school limits career options for young women, and their chance to succeed in a scientific or technical field becomes remote. Why is this happening? What can we, as educators, scientists, and parents do to address this problem? The literature identifies three principal factors that relate to the lack of female involvement in science classes: culture, attitude, and education. This paper reviews these factors and provides examples of programs that Pacific Northwest Laboratory (PNL) and others have developed to increase the number of young women entering college ready and wanting to pursue a career in a scientific or technical field.

23684 (SAND--94-1527) **Crisis prevention centers as confidence building measures: Suggestions for Northeast Asia.** Pregenzer, A.L. Sandia National Labs., Albuquerque, NM (United States). May 1995. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013872. Source: OSTI; NTIS; GPO Dep.

Relationships between countries generally exist somewhere in the grey area between war and peace. Crisis prevention activities are particularly important and should have two goals: stabilizing tense situations that could push countries toward war, and supporting or reinforcing efforts to move countries toward peace. A Crisis Prevention Center (CPC) should facilitate efforts to achieve these goals. Its functions can be grouped into three broad, inter-related categories: establishing and facilitating communication among participating countries; supporting negotiations and consensus-building on regional security issues; and supporting implementation of agreed confidence and security building measures. Technology will play a critical role in a CPC. First, technology is required to establishing communication systems and to provide the means for organizing and analyzing this information. Second, technically-based cooperative monitoring can provide an objective source of information on mutually agreed issues. In addition, technology can be a neutral subject of interaction and collaboration between technical communities from different countries. Establishing a CPC in Northeast Asia does not require the existence of an Asian security regime. Potential first steps for such a CPC should include establishing communication channels and a dedicated communications center in each country, together with an agreement to use the system as a "Hot Line" in bilateral and multilateral emergency situations. A central CPC could also be established as a regional communications hub. The central CPC could coordinate a number of functions aimed at stabilizing regional tensions and supporting confidence building activities, perhaps initially in an unofficial capacity. Specific recommendations for confidence building measures are discussed.

23685 (SAND--95-1251C) **Notes from a quarter century behind a green curtain.** Weiner, R.F. Sandia National Labs., Albuquerque, NM (United States). 27 Jun 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950601--16: Annual meeting of the American Nuclear Society (ANS), Philadelphia, PA (United States), 25-29 Jun 1995). Order Number DE95014601. Source: OSTI; NTIS; GPO Dep.

Experiences as an environmental activist have produced some insights into addressing the current public over-reaction to environmental risks, and in particular to the risks posed by nuclear industry development.

2903 Environment, Health, and Safety

Refer also to citation(s) 22978, 23021, 23242, 23252, 23323, 23324, 23327, 23354, 23452, 23662, 23676, 23677, 23717, 23772,

23781, 23782, 23783, 23784, 23795, 24426, 24442, 24576, 24580, 24588, 24738, 25032

23686 (ANL–95/27) **Information exchange within the U.S. Department of Energy pollution prevention community.** Thuot, J.R. (Argonne National Lab., IL (United States). Environmental Management Operations). Argonne National Lab., IL (United States). Jul 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95016230. Source: OSTI; NTIS; GPO Dep.

Improving Pollution Prevention and Waste Minimization Program (PP/WMIN) technologies, actions, and culture could be an important cost-cutting step for the US Department of Energy (DOE). Communicating ideas, concepts, process changes, and achievements is essential for the success of this program. The need to openly communicate ideas and concepts in a cost-effective manner is essential in an organization that has such diverse components as research and development, weapons production, and power generation. This approach is in contrast to the historic DOE culture developed within the cold war period in which compartmentalization, independence, and secrecy were stressed. DOE has now recognized that for any pollution prevention program to be successful, the many diverse elements of the organization must share information. Avenues for such information exchange are examined in this report.

23687 (ANL/EA/CP–83912) **Hazardous waste cleanup: A case study for developing efficient programs.** Elcock, D.; Puder, M.G. Argonne National Lab., Washington, DC (United States). [1995]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505208–2: Pacific basin conference on hazardous waste, Alberta (Canada), 7-12 May 1995). Order Number DE95013421. Source: OSTI; NTIS; GPO Dep.

As officials in Pacific Basin Countries develop laws and policies for cleaning up hazardous wastes, experiences of countries with such instruments in place may be instructive. The United States has addressed cleanups of abandoned hazardous waste sites through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The US Congress enacted CERCLA in 1980. The task of cleaning up waste sites became larger and more costly than originally envisioned and as a result, Congress strengthened and expanded CERCLA in 1986. Today, many industry representatives, environmentalists, and other interested parties say the program is still costly and ineffective, and Congress is responding through a reauthorization process to change the law once again. Because the law and modifications to it can affect company operations and revenues, industries want to know the potential consequences of such changes. Argonne National Laboratory (ANL) recently developed a baseline for one economic sector – the US energy industry – against which impacts of proposed changes to CERCLA could be measured. Difficulties encountered in locating and interpreting the data for developing that baseline suggest that legislation should not only provide for meeting its stated goals (e.g., protection of human health and the environment) but also allow for its efficient evaluation over time. This lesson can be applied to any nation contemplating hazardous waste cleanup laws and policies.

23688 (ANL/EA/SUMM–84723) **Addressing new policy directions for public scoping: The Multi-Purpose Canister environmental impact statement.** Young, C. (Argonne National Lab., IL (United States)); Metz, W.; Parker, G.J.; Macaluso, C. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950570–27: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95013435. Source: OSTI; NTIS; GPO Dep.

The Department of Energy recently completed the public scoping portion of its public participation program for the Multi-Purpose Canister environmental impact statement This impact statement will be prepared to decide whether to design and implement Multi-Purpose Canisters for managing spent nuclear fuel at commercial power plants. Stakeholders were notified about this impact statement through traditional methods, such as the Federal Register, and more innovative ones, such as electronic media. Educational materials were available to stakeholders to help them better understand the Multi-Purpose Canister programs Finally, diverse techniques were used to solicit comments from stakeholders, including structured comment forms and a toll-free facsimile number. This varied public participation effort addressed the spirit of emerging regulations and elicited nearly 1,000 comments from stakeholders across the country.

23689 (CONF-9506115–8) **Research and institutional dimensions of environmental justice: Implications for NEPA documentation.** Carnes, S.A.; Wolfe, A.K. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From 20. National Association of Environmental Professionals annual conference and exposition: environmental challenges - the next twenty years; Washington, DC (United States); 10-13 Jun 1995. Order Number DE95014276. Source: OSTI; NTIS; GPO Dep.

Satisfying the environmental justice requirements imposed on the NEPA process is a challenging imperative. Among the challenges for NEPA documentation are: (1) adapting existing disciplinary methodologies that address distributional effects to the dictates of the executive order; (2) determining operational and, perhaps, threshold values for policy directives (e.g., disproportionately high and adverse effects); (3) identifying and involving representatives of minority, Native American, and low-income communities and populations in the NEPA process without jeopardizing their independence and integrity; (4) developing strategies, approaches, and methodologies that are more responsive to the consideration of multiple and cumulative exposures; and (5) developing professional standards for environmental justice assessment that are consistent with the letter and intent of the executive order, protective of the environments of minority, Native American, and low-income populations and communities, and useful to decision makers. This report will address current research and institutional activities associated with these issues, present alternative approaches available for their resolution, and identify the implications of those alternative approaches.

23690 (CONF-9506115–9) **From public participation to stakeholder involvement: The rocky road to more inclusiveness.** Peelle, E. Oak Ridge National Lab., TN (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 20. National Association of Environmental Professionals annual conference and exposition: environmental challenges - the next twenty years; Washington, DC (United States); 10-13 Jun 1995. Order Number DE95014275. Source: OSTI; NTIS; GPO Dep.

Surviving always at the edge of extinction, public participation in environmental decision making has an uncertain and problematic history. From its emergence from the urban planning and delivery system efforts of the 1960s to many siting and non-siting uses today, it remains a battleground, with few successes and many failures. While some compelling structural, organizational and cultural explanations for this state of affairs exist, the author offers a further one–a too-limited definition and vision of public participation. One then can argue for a more inclusive process such as stakeholder involvement (SI) to enable a more viable approach to decision making. One can argue that the narrow conceptualization offered in the term public participation (PP) is partly responsible for the meager results of decades of efforts by earnest practitioners. Because of the limited, unique, and self-selected publics that respond to the major PP mechanisms such as public hearings, PP has become largely the province of organized activist groups and is largely accepted as such by most parties, including PP professionals. The author reviews the roles of Congress, federal agencies/proponents, local governments, activist groups and PP professionals in creating the current limited PP processes. She discusses trends and prospects for moving to broader based, more inclusive SI approaches. The emerging SI approach presents major methodological and organizational challenges, but offers the promise of outcomes more likely to be legitimated and potentially more lasting.

23691 (DOE/EA–0969) **Low Energy Accelerator Laboratory Technical Area 53, Los Alamos National Laboratory. Environmental assessment.** Los Alamos National Lab., NM (United

States). Apr 1995. 34p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012126. Source: OSTI; NTIS; INIS; GPO Dep.

This Environmental Assessment (EA) analyzes the potential environmental impacts that would be expected to occur if the Department of Energy (DOE) were to construct and operate a small research and development laboratory building at Technical Area (TA) 53 at the Los Alamos National Laboratory (LANL), Los Alamos, New Mexico. DOE proposes to construct a small building to be called the Low Energy Accelerator Laboratory (LEAL), at a previously cleared, bladed, and leveled quarter-acre site next to other facilities housing linear accelerator research activities at TA-53. Operations proposed for LEAL would consist of bench-scale research, development, and testing of the initial section of linear particle accelerators. This initial section consists of various components that are collectively called an injector system. The anticipated life span of the proposed development program would be about 15 years.

23692 (DOE/EH–231-059/1294) **PCB spill response and notification requirements.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Dec 1994. 4p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015491. Source: OSTI; NTIS; GPO Dep.

Polychlorinated biphenyls (PCBs) are a class of organic chemicals that had become widely used in industrial applications due to their practical physical and chemical properties. Historical uses of PCBs include dielectric fluids (used in utility transformers, capacitors, etc.), hydraulic fluids, and other applications requiring stable, fire-retardant materials. Due to findings that PCBs may cause adverse health effects and due to their persistence and accumulation in the environment. The Toxic Substances Control Act (TSCA), enacted on october 11, 1976, banned the manufacture of PCBs after 1978 [Section 6(e)]. The first PCB regulations, promulgated at 40 CFR Part 761, were finalized on February 17, 1978. These PCB regulations include requirements specifying disposal methods and marking (labeling) procedures, and controlling PCB use. To assist the Department of Energy (DOE) in its efforts to comply with the TSCA statute and implementing regulations, the Office of Environmental Guidance has prepared the document "Guidance on the Management of Polychlorinated Biphenyls (PCBs)." That document explains the requirements specified in the statute and regulations for managing PCBs including PCB use, storage, transport, and disposal. The Environmental Protection Agency (EPA) established regulations at 40 CFR 761 Subpart G for the reporting and cleanup of spills resulting from the release of any quantity of materiai containing PCBs at concentrations of $\geq$ 50 ppm. The regulations, known collectively as the TSCA Spill Cleanup Policy, contain requirements for the notification, cleanup, decontamination verification, and recordkeeping of PCB spills. This Information Brief supplements the PCB guidance document by responding to common questions concerning PCB spill response and notification requirements. It is one of a series of Information Briefs pertinent to PCB management issues.

23693 (DOE/EH–95010741) **Environmental guidance regulatory bulletin.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Dec 1994. 7p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95010741. Source: OSTI; NTIS; INIS; GPO Dep.

On September 22,1993, the Environmental Protection Agency (EPA) published [58 Federal Register (FR) 492001 the final OffSite Rule, which defines criteria for approving facilities for receiving waste from response actions taken under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The off-site requirements apply to the off-site management of hazardous substances, pollutants, and contaminants, as defined under CERCLA, that are generated from remedial and removal actions funded or authorized, at least in part, by CERCLA. CERCLA-authorized cleanups include those taken under lead-agency authority, Section 106 Consent Orders, Consent Agreements, Consent Degrees, and Records of Decision (RODs). EPA requires that remedial actions at Federal facilities taken under Sections 104, 106, or 120 of CERCLA comply with the Off-Site Rule for all cleanups enacted through DOE's lead-agency authority.

23694 (DOE/EH–95015009) **Certain glycol ethers eliminated from toxic chemical release reporting requirements.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Sep 1994. 2p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015009. Source: OSTI; NTIS; GPO Dep.

Effective June 28, 1994, the U.S. Environmental Protection Agency (EPA) eliminated high molecular weight glycol ethers from the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA). EPCRA (42 U.S.C. 11023) is also referred to as Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986. EPA redefined the glycol ethers category list of chemicals subject to reporting based on an EPA review of available human health data on short-chain glycol ethers. EPA is removing only the surfactant glycol ethers, which are high molecular weight glycol ethers, i.e., those with pendant alkyl groups and that typically have eight or more carbon atoms. The redefinition retains certain glycol ethers (i.e., ethylene glycol ethers where there are 1,2, or 3 repeating ethylene oxide groups) in the category. These are reasonably anticipated to cause adverse human health effects.

23695 (DOE/EIS–0217-Vol.1) **Savannah River Site Waste Management Environmental Impact Statement. Volume 1, Final.** USDOE Savannah River Operations Office, Aiken, SC (United States). Jul 1995. 796p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015754. Source: OSTI; NTIS; INIS; GPO Dep.

Purpose of this environmental impact statement is to help DOE decide how to manage over the next 30 years liquid high-level radioactive, low-level radioactive, mixed, hazardous, and transuranic wastes generated during 40 years of past operations and on-going activities at Savannah River Site (SRS) in southwestern South Carolina. The wastes are currently stored at SRS. DOE seeks to dispose of the wastes in a cost-effective manner that protects human health and the environment. In this document, DOE assesses the cumulative environmental impacts of storing, treating, and disposing of the wastes, examines the impacts of alternatives, and identifies measures available to reduce adverse impacts. Evaluations of impacts on water quality, air quality, ecological systems, land use, geologic resources, cultural resources, socioeconomics, and the health and safety of onsite workers and the public are included in the assessment.

23696 (DOE/EIS–0232) **EIS Implementation Plan: Western-Sacramento 2004 Power Marketing Program.** USDOE, Washington, DC (United States). Mar 1995. 35p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012125. Source: OSTI; NTIS; GPO Dep.

Western-Sacramento currently serves 76 preference power customers in northern and central California. Due to the expiration of the long-term CVP power contracts and Contract 2948A on December 31, 2004, Western-Sacramento is developing a post-2004 Power Marketing Plan to analyze options for renewing and/or replacing these expiring contracts. The development and adoption of the Marketing Plan to market power from the Central Valley and Washoe projects is the subject of this environmental impact statement (EIS) process. Before Western-Sacramento defines a new power marketing program, Western-Sacramento will comply with the National Environmental Policy Act (NEPA) (42 USC 4321 through 4370d) environmental review procedures to determine the range of power marketing alternatives available and their associated environmental impacts and mitigation opportunities.

23697 (DOE/RL–93-66) **Hanford Remedial Action Environmental Impact Statement, Richland, Washington. Implementation Plan.** USDOE Richland Operations Office, WA (United States). Jun 1995. 167p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014919. Source: OSTI; NTIS; INIS; GPO Dep.

This implementation plan was prepared in compliance in compliance with 10 CFR 1021. It includes the following sections:

introduction; purpose and need for departmental action; scope, content, and alternatives for the HRA EIS; public participation process; schedule for preparation of the HRA EIS; anticipated environmental reviews and consultations; and contractor disclosure statement. The following appendices are also included: notice of intent, federal register notice for extension of public scoping period, proposed annotated outline for the draft HRA EIS, summary of final report for the Hanford Future Site Uses Working Group, and summary of comments and responses from the public scoping process.

23698 (ENEA-RT-AMB--94-27) **Analysis of quality life in two factories of Civita Castellana pottery district (Italy).** Dai Pra', L. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Delle Fratte, A.; Salerno, S. ENEA, Casaccia (Italy). Area Energia Ambiente e Salute. Nov 1994. 88p. (In Italian). Order Number DE95789768. Source: OSTI; NTIS (US Sales Only).

The aim of this research is the analysis of job satisfaction and quality of life in two of the most important representative factories of Civita Castellana pottery district located near Rome (Italy). The two factories were before studied by the Method of Organizational Congruences (MOC) and the results obtained published in another technical report (ENEA-RT-AMB--93-24). It is analized worker's job and life satisfaction by a structured interview with various open questions in such a way to reveal also many hidden feelings. The 103 structured interviews (in-table-ware 17 women and 55 men; in sanitary-ware 30 men and 1 woman) emphasize the experience at work, the opinions and attitudes about it and the style of life. The results obtained confirm the different Organizational Constraint (OC) in the two factories that have various degrees of technology innovation. Nevertheless the workers who were interviewed show high job satisfaction and high degree of life: This incongruence is dealt with in this work.

23699 (ETDE-DE--109) **Use of renewable energy sources in Bavaria - state of the art and potential assessment. A climate protection study.** Umwelt und Entwicklung Bayern. Materialien, v. 86. Landtechnischer Verein in Bayern e.V., Freising (Germany). Apr 1993. 312p. (In German). Sponsored by Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany). Order Number DE95778136. Source: OSTI; NTIS (US Sales Only).

This study wants to give an overview of renewable or recoverable energy sources. Following an introduction giving exact definitions of individual techniques, the potential of each energy source is assessed. The potential that these energy sources have for reducing the atmospheric pollution burden is particularly dealt with. However, the focus of the study is on the current practical use of renewable energy sources. Several inquiries with a great number of firms were to provide information on the number of existing plants and their technical standard. Some plants were included in reference lists. (orig./HW)

23700 (ETDE-DE--176) **Europe - environmental compatibility without frontiers?.** Journalistenseminar der Information Umwelt, v. 14. Assmann, G. (comp.); Froese, B. (comp.); Haury, H.J. (comp.); Jahn, T. (comp.). GSF - Forschungszentrum fuer Umwelt und Gesundheit Neuherberg GmbH, Oberschleissheim (Germany). Projekt Information Umwelt. 1994. 77p. (In German). (CONF-9408243--: 14. journalists seminar on environmental information: Europe - environmentally friendly without limits?, Frankfurt am Main (Germany), 4 Aug 1994). Order Number DE95795828. Source: OSTI; NTIS (US Sales Only).

The seven contributions discuss decision processes in European environmental protections, environmental associations within the European Union, trends in European waste management policy and their effecsts on EC member states, and the problem of environmental protection in central and Eastern Europe. The particular importance of agricultural and traffic policy in the contect of environmental policy is pointed out. (DG)

23701 (IAEA-TECDOC--793) **Nuclear power: An overview in the context of alleviating greenhouse gas emissions.** International Atomic Energy Agency, Vienna (Austria); Nuclear Energy Agency, 75 - Paris (France). Apr 1995. 41p. Order Number DE95631168. Source: OSTI; NTIS (US Sales Only); INIS.

The document gives a brief overview of the current development of nuclear power worldwide, covering essentially technical, economic and environmental aspects. Policy issues related to implementation instruments and potential barriers to nuclear power deployment are also touched upon. Views are given on the possible medium and long term development of nuclear power, as a means for alleviating greenhouse gas emissions from the electricity sector. Advanced technologies for the reactors and their associated fuel cycles are described, including advanced fission reactors and fusion energy. Direct cost and externalities are given for the present generation of nuclear power plants as well as for power plants to be commissioned in the coming decades. Environmental burdens and risks are analysed with emphasis on potential risks of accident, radioactive waste, and atmospheric emission in routine operation, focusing on greenhouse gases. 77 refs, 1 fig., 4 tabs.

23702 (ORNL/TM--13031) **The use of explosives by the US Antarctic Program. Environmental report.** Ensminger, J.T.; Blasing, T.J. Oak Ridge National Lab., TN (United States). Jun 1995. 39p. Sponsored by National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95016398. Source: OSTI; NTIS; GPO Dep.

This report was prepared to assist principal investigators and others in complying with NEPA and the protocol on environmental protection to the Antarctic Treaty. Research activities and associated support operations in Antarctica sometimes require use of explosives. This report evaluates potential environmental impacts associated with such activities and possible methods for mitigating those impacts. The greatest single use of explosives, and the only type of blasting that will occur on the Polar Plateau (an exception is the rare use of explosives to cave in dangerous ice for safety reasons), is for seismic surveys. The charges for these are small-scale, are placed in or on the snow or ice, are distributed linearly over long distances, and present no potential impacts to soil or geological substrata. Impacts from those would be less than minor or transitory. Wherever possible, blasting holes in sea ice will be replaced by drilling by auger or melting. Other uses of explosives, such as in geologic research and construction, are discussed.

23703 (PNL-SA--25942) **Federal, state and utility roles in reducing new building greenhouse gas emissions.** Johnson, J.A. (Pacific Northwest Lab., Richland, WA (United States)); Shankle, D.; Boulin, J. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9503114--2: 3. national new construction programs for demand side management conference, Boston, MA (United States), 26-29 Mar 1995). Order Number DE95014617. Source: OSTI; NTIS; GPO Dep.

This paper will explore the role of implementation of building energy codes and standards in reducing US greenhouse gas emissions. It will discuss the role of utilities in supporting the US Department of Energy (DOE) and the Environmental Protection Agency in improving the efficiency of new buildings. The paper will summarize Federal policies and programs that improve code compliance and increase overall greenhouse gas emission reductions. Finally, the paper will discuss the role of code compliance and the energy and greenhouse gas emission reductions that have been realized from various Federal, State and utility programs that enhance compliance.

23704 (PNL-SA--25948) **The value added of conducting regional versus local stakeholder involvement in evaluating technology acceptance.** McCabe, G.H. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950646--24: Air and Waste Management Association meeting, San Antonio, TX (United States), 18-23 Jun 1995). Order Number DE95014628. Source: OSTI; NTIS; INIS; GPO Dep.

Battelle has conducted a three-year effort, funded by the U. S Department of Energy's (DOE) Office of Technology Development, to involve stakeholders in evaluating innovative technologies to clean up volatile organic compound (VOC) contamination at arid sites. Stakeholders have been encouraged to participate in the demonstration of these innovative technologies in order to improve

decisions made by DOE and its contractors about technology development, demonstration, and deployment. The basic approach is to identify people and organizations with a stake in the remediation process, and hence in the demonstration of innovative technologies. Stakeholders have included public interest group and environmental group representatives, regulators, technology users, Native Americans, Hispanic community members, and local elected officials. These people are invited to be involved and they are presented with substantive information about the technologies. Their input in terms of identifying issues and concerns, defining the kinds of information needed from the demonstrations, and assessing the acceptability of the technologies for deployment, will help ensure that only broadly promising technologies are carried forward. This approach is designed to increase the likelihood of successful deployment of the new technologies needed to accomplish environmental restoration throughout the DOE complex and at private facilities. The hypothesis in conducting this regional stakeholder involvement program is that there will be different data requirements for different sites due to geographical, institutional, programmatic, and cultural differences at the sites. Identifying the broadest set of data requirements, collecting this information during the technology demonstration, and providing the results of the demonstration to stakeholders will enhance the acceptance of the technology at these sites and, thereby, enhance the technology's deployability.

23705 (PNL-SA–26129) **Using new replication features of Oracle 7 in emergency management system.** Loveall, R.M. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 9p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9504186–1: ORACLE/DOE special interest group meeting on emergency management system, Richland, WA (United States), 19-21 Apr 1995). Order Number DE95014631. Source: OSTI; NTIS; GPO Dep.

Pacific Northwest Laboratory is developing an application for the Army and the Federal Emergency Management Agency to support emergency management of hazards resulting from the accidental release of chemical agents during their storage or destruction. This application, called the Federal Emergency Management Information System (FEMIS), uses Oracle7.1 in a client/server configuration. At each Army site where FEMIS is deployed, there will be two or more servers and about 25 users on client personal computers (PCs) connected to each server. The Oracle Data Base Management System is configured as a multiserver, distributed data base using partitioning to share information between the Oracle instances. The information in the individual partitioned tables is merged by Union operators to form a set of site-wide views. This data base contains more than 180 tables and about 40 additional site views. Oracle snapshot replication was chosen rather than distributed queries in order to achieve autonomous operation and improve failure tolerance. The presentation will describe this architecture and discuss how the data was partitioned. Some useful techniques for generating the scripts that produce the data base will also be discussed.

23706 (PNL-SA–26159) **Destruction of chlorofluorocarbons and halons.** Matchett, J.M.; Miller, K.B.; Purcell, C.W. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9506115–10: 20. National Association of Environmental Professionals annual conference and exposition: environmental challenges - the next twenty years, Washington, DC (United States), 10-13 Jun 1995). Order Number DE95014621. Source: OSTI; NTIS; GPO Dep.

The Montreal Protocol on Substances that Deplete the Ozone Layer requires the phaseout of ozone-depleting substances in most developed countries by January 1, 1996. Developing, or Article 5, countries have been allowed additional time in which to produce these chemicals. Contrary to the Protocol's intent, current estimates indicate that production of these chemicals by Article 5 countries could easily equal that of the developed world before their production is required to be eliminated. The Montreal Protocol also requires that used chlorofluorcarbons (CFCs) and halons are disposed of in an environmentally acceptable manner. One mechanism devised by the Montreal Protocol to reduce the amount of ozone-depleting substances that may need to be destroyed is to transfer those chemicals to Article 5 countries. Theoretically, this has the added benefit of also eliminating the need for additional production by those countries. This paper discusses the major issues associated with the disposal/destruction of ozone-depleting substances, including the transfer of these chemicals to Article 5 countries. Potential implications of the barriers to ozone-depleting substance transfer on the viability of the Montreal Protocol will also be discussed.

23707 (SAND–95-1434/2) **Style, content and format guide for writing safety analysis documents: Volume 2, Safety assessment reports for DOE non-nuclear facilities.** Mahn, J.A.; Silver, R.C.; Balas, Y.; Gilmore, W. Sandia National Labs., Albuquerque, NM (United States). Jul 1995. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015734. Source: OSTI; NTIS; GPO Dep.

The purpose of Volume 2 of this 4-volume style guide is to furnish guidelines on writing and publishing Safety Assessment Reports (SAs) for DOE non-nuclear facilities at Sandia National Laboratories. The scope of Volume 2 encompasses not only the general guidelines for writing and publishing, but also the prescribed topics/appendices contents along with examples from typical SAs for DOE non-nuclear facilities.

23708 (UCRL-ID–121067) **The Aegis initiative: An integrated, real-time, environmental monitoring and response management capability. Final report.** Smart, J.C.; Vellinger, R.J. Lawrence Livermore National Lab., CA (United States). 21 Mar 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013918. Source: OSTI; NTIS; GPO Dep.

The Aegis system at Lawrence Livermore National Laboratory (LLNL) is being developed to provide a real-time emergency response management capability for a diverse range of environmental monitoring applications. The Aegis system is designed to integrate a variety of environmental, emergency, and process monitoring sensor systems using a flexible, modular architecture that can be readily configured for any number of industrial, commercial, or government sites. Several unique LLNL technologies are being integrated via this effort that will provide tracking of environmental contaminants, real-time identification of potentially unacceptable conditions, and facilitation of emergency or measured response management operations. Potential areas of application include: monitoring-surface/ground water, air, radiation; waste effluent & storm/drain line; water quality (water storage, treatment, and distribution); fixed processes, safety systems; critical facilities; hazardous spill management; rapid environmental monitoring deployment; watershed protection; ecosystem management and restoration; enforcement and compliance.

23709 (WHC-SA–2722) **A model for determining the scope and level of detail that is appropriate for a programmatic EIS.** Eccleston, C.H. Westinghouse Hanford Co., Richland, WA (United States). Mar 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9506115–3: 20. National Association of Environmental Professionals annual conference and exposition: environmental challenges - the next twenty years, Washington, DC (United States), 10-13 Jun 1995). Order Number DE95012574. Source: OSTI; NTIS; INIS; GPO Dep.

Since the inception of the National Environmental Policy Act (NEPA), no definitive guidance has been established for determining the scope of topics and issues, or the level of detail suitable for presentation within a Programmatic Environmental Impact Statement (P-EIS). Lacking such guidance, an inordinate amount of time and resources can be expended in determining the scope that is most appropriately addressed within a P-EIS versus the more detailed scope that is best reserved for lower-tier documents. Faced with this predicament, agencies often err on the side of including too much detail, resulting in P-EISs that are over bloated and unnecessarily complex. Moreover, lack of definitive guidance leads to a great deal of inconsistency in the preparation of P-EISs among federal agency programs. A paradigm for assisting decisionmakers in making such determinations is presented below. This model expedites the preparation of P-EISs by providing a consistent and systematic approach for determining the scope and level of detail

that is most appropriately addressed at the programmatic level. In many cases, the model provides agencies with an effective tool for managing and streamlining the NEPA process by de-scoping needless and unnecessary issues from the scope of a P-EIS.

2904 Energy Resources

Refer also to citation(s) 23721

23710 (DOE/EIA–0035(95/07)) **Monthly energy review, July 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 24 Jul 1995. 182p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015816. Source: OSTI; NTIS; GPO; GPO Dep.

Energy production during April 1995 totaled 5.5 quadrillion Btu, a 1.0-percent decrease from the level of production during April 1994. Coal production decreased 7.7 percent, natural gas increased 1.3 percent, and production of crude oil and natural gas plant liquids increased 0.3 percent. All other forms of energy production combined were up 8.6 percent from the level of production during April 1994.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 23021, 23129, 23744, 23786, 24059, 24978

23711 (BNL–61738) **The Amtex DAMA Project: The Brookhaven contribution.** Peskin, A.M. Brookhaven National Lab., Upton, NY (United States). Jan 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95013259. Source: OSTI; NTIS; GPO Dep.

The Amtex Partnership organized in 1993 as a Technology Transfer Collaboration among members of the integrated textile industry, the DOE National Laboratories, a number of universities, and several research/education/technology transfer organizations (RETTs). Under the Amtex umbrella organization, a number of technology areas were defined and individual projects were launched addressing various aspects of improving the health and competitiveness of the American textile industry. The first and, to date, the largest of these has been the computer-based Demand Activated Manufacturing Architecture (DAMA) project. Brookhaven National Laboratory became involved in DAMA beginning in March of 1993 and remained an active participant through January of 1995. It was staffed almost exclusively with personnel of the Computing and Communications Division. This document summarizes the activities and accomplishments of the Brookhaven team in working with the larger collaboration. Detailed information about the Amtex Partnership, the DAMA Project, and specific BNL contributions are documented elsewhere.

23712 (DOE/ER–0649T) **Graduate student theses supported by DOE's Environmental Sciences Division.** Cushman, R.M. (Oak Ridge National Lab., TN (United States)); Parra, B.M. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Jul 1995. 128p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015971. Source: OSTI; NTIS; GPO Dep.

This report provides complete bibliographic citations, abstracts, and keywords for 212 doctoral and master's theses supported fully or partly by the U.S. Department of Energy's Environmental Sciences Division (and its predecessors) in the following areas: Atmospheric Sciences; Marine Transport; Terrestrial Transport; Ecosystems Function and Response; Carbon, Climate, and Vegetation; Information; Computer Hardware, Advanced Mathematics, and Model Physics (CHAMMP); Atmospheric Radiation Measurement (ARM); Oceans; National Institute for Global Environmental Change (NIGEC); Unmanned Aerial Vehicles (UAV); Integrated Assessment; Graduate Fellowships for Global Change; and Quantitative Links. Information on the major professor, department, principal investigator, and program area is given for each abstract. Indexes are provided for major professor, university, principal investigator, program area, and keywords. This bibliography is also available in various machine-readable formats (ASCII text file, WordPerfect® files, and PAPYRUS™ files).

23713 (NEDO-OS–9401) **Research and development project plans for FY 1994. 1. Research and development of new energy.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Apr 1994. 135p. Order Number DE95790767. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

Plans were introduced for research and development of new energy for fiscal 1994. Plans stated in coal conversion technology were such as implementation plan for developing coal liquefaction technology, implementation plan for developing technology for coal-based hydrogen production, implementation plan for research and development of coal hydrogenation gasification technology, implementation plan for development of next generation of coal utilization technology, implementation plan for clean coal technology promotion project, and implementation plan for international coal utilization project. Plans stated in solar energy technology were such as implementation plan for research on thin substrate polycrystalline solar cell manufacturing technology development, implementation plan for research on thin film solar cell manufacturing technology, implementation plan for super high-efficiency solar cell technology development, implementation plan for developing technology for photovoltaic power generation systems, and implementation plan for international cooperative research and development project on photovoltaic power generation systems. Plans stated in geothermal energy technology were such as development of a binary cycle power generation plant, development of a hot dry rock power generation system, and development of drilling and production technology for deep-seated geothermal resources. Plans stated in other categories were such as fuel cell power generation technology and alcohol and biomass energy technology.

23714 (ORNL/TM–12902) **High Temperature Materials Laboratory seventh annual report, October 1993–September 1994.** Tennery, V.J.; Teague, P.A. Oak Ridge National Lab., TN (United States). Dec 1994. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013968. Source: OSTI; NTIS; GPO Dep.

The High Temperature Materials Laboratory (HTML) has completed its seventh year of operation as a designated Department of Energy User Facility at the Oak Ridge National Laboratory. Growth of the User Program has been demonstrated by the number of institutions executing user agreements since the HTML began operation in 1987. A total of 193 nonproprietary agreements (91 industry and 102 university) and 41 proprietary agreements (39 industry and two university) are now in effect. This represents an increase of 21 nonproprietary user agreements during FY 1994. Forty-one states are represented by these users. During FY 1994, the HTML User Program evaluated 106 nonproprietary proposals (46 from industry, 52 from universities, and 8 from other government facilities) and 8 proprietary proposals. The HTML User Advisory Committee approved about ninety-five percent of those evaluated proposals, sometimes after the prospective user revised the proposal based on comments from the Committee. This annual report discusses FY 1994 activities in the individual user centers, as well as plans for the future. It also gives statistics about users and their proposals and FY 1994 publications, and summarizes nonproprietary research projects active in FY 1994.

23715 (PNL–10519-2) **The AMTEX Partnership. Second quarter report, Fiscal Year 1995.** Lemon, D.K. (AMTEX Partnership (United States)); Quisenberry, R.K. Pacific Northwest Lab., Richland, WA (United States); AMTEX Partnership (United States). Mar 1995. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015136. Source: OSTI; NTIS; GPO Dep.

The AMTEX Partnership™ is a collaborative research and development program among the US Integrated Textile Industry, the Department of Energy (DOE), the national laboratories, other federal agencies and laboratories, and universities. The goal of AMTEX is to strengthen the competitiveness of this vital industry, thereby reserving and creating US jobs. The operations and program management of the AMTEX Partnership is provided by the Program Office. This report is produced by the Program Office on

a quarterly basis and provides information on the progress, operations, and project management of the partnership.

23716 (SAND–94-1945) **ITEP: A survey of innovative environmental restoration technologies in the Netherlands and France.** Roberds, W.J. (Golder Associates, Inc., Redmond, WA (United States)); Voss, C.F.; Hitchcock, S.A. Sandia National Labs., Albuquerque, NM (United States); Golder Associates, Inc., Redmond, WA (United States). May 1995. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015057. Source: OSTI; NTIS; INIS; GPO Dep.

The International Technology Exchange Program (ITEP) of the Department of Energy's (DOE's) Office of Environmental Management (EM) is responsible for promoting the import of innovative technologies to better address EM's needs and the export of US services into foreign markets to enhance US competitiveness. Under this program, potentially innovative environmental restoration technologies, either commercially available or under development in the Netherlands and France, were identified, described, and evaluated. It was found that 12 innovative environmental restoration technologies, which are either commercially available or under development in the Netherlands and France, may have some benefit for the DOE EM program and should be considered for transfer to the United States.

23717 (SAND–94-1946) **A survey of environmental needs and innovative technologies in Germany.** Voss, C.F. (Golder Associates, Inc., Redmond, WA (United States)); Roberds, W.J. Sandia National Labs., Albuquerque, NM (United States); Golder Associates, Inc., Redmond, WA (United States). May 1995. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015058. Source: OSTI; NTIS; INIS; GPO Dep.

The International Technology Program (IT?), formerly the international Technology Exchange Program (ITEP), of the Department of Energy's (DOE's) Office of Environmental Restoration and Waste Management (EM) is responsible for promoting: (1) the import of innovative technologies to better address EM's needs; and (2) the export of US services into foreign markets to enhance US competitiveness. Under this program: (1) the environmental restoration market in Germany was evaluated, including the description of the general types of environmental problems, the environmental regulations, and specific selected contaminated sites; and (2) potentially innovative environmental restoration technologies, either commercially available or under development in Germany, were identified, described and evaluated. It was found that: (1) the environmental restoration market in Germany is very large, on the order of several billion US dollars per year, with a significant portion possibly available to US businesses; and (2) a large number (54) of innovative environmental restoration technologies, which are either commercially available or under development in Germany, may have some benefit to the DOE EM program and should be considered for transfer to the US.

23718 (UCRL-ID–114972-2) **SERS internship: Spring 1994 abstracts and research papers.** Goldman, B. Lawrence Livermore National Lab., CA (United States). 6 May 1994. 195p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9405328–Absts.: Science and Engineering Research Semester (SERS) student symposium, Livermore, CA (United States), 6 May 1994). Order Number DE95014118. Source: OSTI; NTIS; GPO Dep.

This document contains abstracts from the science and engineering research semester from the Lawrence Livermore National Laboratory. Projects cover many areas in the fields of contaminant removal from the environment, physics, and genetics research. Individual projects were processed separately for the Department of Energy databases.

2906 Nuclear Energy

Refer also to citation(s) 23252, 23382, 23403, 23561, 23687, 23739

2908 Heat Utilization

Refer also to citation(s) 23679, 23680

2910 Conservation

Refer also to citation(s) 23737

23719 (ETDE-DE–138) **Climate-compatible energy supply in Baden-Wuerttemberg. Rational use of electricity in households.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 10. Baur, J. (Stuttgart Univ. (Germany). Inst. fuer Energiewirtschaft und Rationelle Energieanwendung (IER)); Bohnhoff, C.; Fahl, U.; Voss, A. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 124p. (In German). Order Number DE95790278. Source: OSTI; NTIS (US Sales Only).

The report contains technical analyses of household appliances which are not used for room or service water heating (coolers and refrigerators; cooking appliances; washing machines and driers; dishwashers; lighting; small appliances). Each group of appliances is analyzed in five steps. In the first step, "technology description", the function and technical variants of the systems are described. The second step analyzes technical and non-technical options for consumption reduction. In the third step, the structure of the present "appliances park" is described. the fourth step analyzes average and optimum consumption data, while the fifth step goes into "technology-related obstacles". The investigations were carried out for the purpose of determining the potential contribution of low-consumption household appliances to energy savings and pollutant reduction today and tomorrow.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 23099, 23682, 23730

23720 (DOE/EIA–0484(95)) **International energy outlook 1995, May 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Integrated Analysis and Forecasting. Jun 1995. 103p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014139. Source: OSTI; NTIS; GPO; GPO Dep.

The International Energy Outlook 1995 (IEO95) presents an assessment by the Energy Information Administration (EIA) of the international energy market outlook through 2010. The report is an extension of the EIA's Annual Energy Outlook 1995 (AEO95), which was prepared using the National Energy Modeling System (NEMS). US projections appearing in the IEO95 are consistent with those published in the AEO95. IEO95 is provided as a statistical service to energy managers and analysts, both in government and in the private sector. The projects are used by international agencies, Federal and State governments, trade associations, and other planners and decisionmakers. They are published pursuant to the Department of energy Organization Act of 1977 (Public Law 95-91), Section 295(c). The IEO95 projections are based on US and foreign government policies in effect on October 1, 1994. IEO95 displays projections according to six basic country groupings. The regionalization has changed since last year's report. Mexico has been added to the Organization for Economic Cooperation and Development (OECD), and a more detailed regionalization has been incorporated for the remainder of the world, including the following subgroups: non-OECD Asia, Africa, Middle East, and Central and South America. China is included in non-OECD Asia. Eastern Europe and the former Soviet Union are combined in the EE/FSU subgroup.

23721 (ETDE-BR–0019) **Integrated energy plan for Minas Gerais state, Brazil.** Companhia Energetica de Minas Gerais (CEMIG), Belo Horizonte, MG (Brazil). Apr 1993. 139p. (In Portugese). Order Number DE95789963. Source: OSTI; NTIS (US Sales Only).

The energetic matrix of Minas Gerais state, Brazil is presented mentioning all the resources available and analysing the energy supply and demand on a integrated way. The critical points and action lines in the energy sector aiming the economic growth of the

state are identified. The impacts over the vegetation and the possible deficits in the charcoal and firewood demand are studied in order to promote the conservation and the energy substitution by the charcoal consumers. The energy conservation is also shown by the residue recovery from the industrial sector as siderurgical gases and sugar cane bagasse by the cogeneration. It is presented also the main aspects of natural gas coming for the state with a forecasting for the year 2000 when this source of energy will participate with 4% in the State Energetic Matrix. 25 figs, 54 tabs

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 23242, 23404, 23562, 23676, 23693

23722 (DOE/IG–0002/95) **Semiannual report to Congress, October 1, 1994–March 31, 1995.** USDOE Office of Inspector General, Washington, DC (United States). Apr 1995. 78p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI.

The Office of Inspector General Semiannual Report to the Congress covers the period October 1, 1994, through March 31, 1995. The report summarizes significant audit, inspection and investigative accomplishments for the reporting period, a large number of which facilitated Department management's efforts to improve management controls and ensure efficient and effective operation. Narratives of the most significant reports are grouped by six primary performance measures: (1) Recommendations accepted by management, (2) Audit/inspection savings, recoveries, and funds identified for better use, (3) Legislative/regulatory compliance to recommendations, (4) Positive impacts on the Department after implementation of recommendations, (5) Complaints resolved, and (6) Investigation recoveries, fines, and funds identified for better use.

23723 (NUREG/CR–6307) **Summary of comments received at workshop on use of a Site Specific Advisory Board (SSAB) to facilitate public participation in decommissioning cases.** Caplin, J. (Advanced Systems Technology, Inc., Rockville, MD (United States)); Padge, G.; Smith, D.; Wiblin, C. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Advanced Systems Technology, Inc., Rockville, MD (United States). Jun 1995. 103p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

The Nuclear Regulatory Commission (NRC) is conducting an enhanced participatory rulemaking to establish radiological criteria for the decommissioning of NRC-licensed facilities. As part of this rulemaking, On August 20, 1994 the NRC published a proposed rule for public comment. Paragraph 20.1406(b) of the proposed rule would require that the licensee convene a Site Specific Advisory Board (SSAB) if the licensee proposed release of the site for restricted use after decommissioning. To encourage comment the NRC held a workshop on the subject of $SABs on December 6, 7, and 8, 1994. This report summarizes the 567 comments categorized from the transcript of the workshop. The commenters at the workshop generally supported public participation in decommissioning cases. Many participants favored promulgating requirements in the NRC's rules. Some industry participants favored relying on voluntary exchanges between the public and the licensees. Many participants indicated that a SSAB or something functionally equivalent is needed in controversial decommissioning cases, but that some lesser undertaking can achieve meaningful public participation in other cases. No analysis or response to the comments is included in this report.

23724 (NUREG/CR–6330) **Results of regulatory impact survey of industrial and medical materials licensees of the Office of Nuclear Material Safety and Safeguards.** Lach, D. (Battelle Human Affairs Research Center, Seattle, WA (United States)); Melber, B.; Brichoux, J.; Hattrup, M.; Conger, R.; Hughes, K. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Industrial and Medical Nuclear Safety; Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 87p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–10548). Source: OSTI; NTIS; GPO; INIS.

This report presents the findings of a regulatory impact survey of nuclear materials licensees of the United States Nuclear Regulatory Commission (NRC). Commissioners of the NRC directed staff to provide the Commission with first hand information from licensees that could be used to improve the overall regulatory program. A self-administered, mail-out survey questionnaire was used to collect data from a sample of licensees who had interaction with the NRC during the previous 12 months. A total of 371 respondents of the 589 who were sent questionnaires returned completed surveys, for a response rate of 63%. The body of the report presents the findings of the survey including a brief introduction to the approach used, followed by survey findings regarding regulations, policies and regulatory guidance; experience with licensing applications, renewals and amendments; inspections; reporting requirements; and enforcement actions. The appendices of the report include a copy of the survey as administered to licensees, a fuller description of the survey design and data collection methods, and detailed graphic material describing survey responses.

2940 Fossil Fuels

Refer also to citation(s) 23099, 23108, 23122, 23710, 23720, 23735, 23738, 23739, 23740, 23759

23725 (INIS-mf–14549, pp. 34-43) **Experience of the Czech National Energy Inspectorate from the conversion of energy sources in the North-Bohemian region to gas fuel.** Spolek, J. (Statni Energeticka Inspekce, Usti nad Labem (Czech Republic)). DUM Techniky Usti s.r.o., Usti nad Labem (Czech Republic). Feb 1994. (In Czech). (CONF-9410360–: 4. natural gas, power industry and the environment, Usti nad Labem (Czech Republic), 25-26 Oct 1994). In *Power industry and the environment IV. Natural gas.* 173p. Order Number DE95633438. Source: OSTI; NTIS (US Sales Only); INIS.

Regional energy policy problems in northern Bohemia are discussed, as are the energy savings resulting from the use of fuel gases for room heating and water heating. Heating costs are given for various fuels, and the efficiency and air pollution data are compared for them. (J.B.). 4 tabs.

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 23413, 23824

2960 Electric Power

Refer also to citation(s) 23100, 23533, 23710, 23719, 23720, 23739, 23740, 23789

23726 (ANL/DIS/CP–85733) **A survey of publicly available transfer capability data.** Kavicky, J.A.; VanKuiken, J.C. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950414–5: 57. annual American power conference, Chicago, IL (United States), 18-20 Apr 1995). Order Number DE95013786. Source: OSTI; NTIS; GPO Dep.

This paper summarizes the transmission system data resources used to construct a North American network representation modeled in the Spot Market Network (SMN) model developed at Argonne National Laboratory (ANL). The data, largely available through various FERC Form 715 reports, are used to construct a network representation capable of modeling interarea transfer opportunities between modeled systems. A brief introduction of the SMN model and the desired level of transmission detail is first described. Next, various data resources that report published transfer capabilities essential to model operation are introduced. Modifications or adaptations of individual published network topologies are described, which are supported through extensive examinations of alternate data sources, as well as through discussions with knowledgeable operations experts or regional staff. The method of obtaining the current SMN network formulation is finally presented to illustrate the integration of regional and subregional network detail into the North American SMN transmission representation.

23727 (CONF-941089–Vol.1, pp. 23-37) **Electric power industry in Korea: Past, present, and future.** Lee, Hoesung. US-DOE, Washington, DC (United States); Korea Electric Power Corp. (KEPCO), Seoul (Korea, Republic of). [1994]. From US-Korea electric power generation seminar mission; Seoul (Korea, Republic of); 24-28 Oct 1994. In *US-Korea Electric Power Generation Seminar Mission: Proceedings, Volume 1.* 459p. Order Number DE95011612. Source: OSTI; NTIS; INIS; GPO Dep.

Electrical power is an indispensable tool in the industrialization of a developing country. An efficient, reliable source of electricity is a key factor in the establishment of a wide range of industries, and the supply of energy must keep pace with the increasing demand which economic growth creates in order for that growth to be sustained. As one of the most successful of all developing countries, Korea has registered impressive economic growth over the last decade, and it could be said that the rapid growth of the Korean economy would not have been possible without corresponding growth in the supply of electric power. Power producers in Korea, and elsewhere in Asia, are to be commended for successfully meeting the challenge of providing the necessary power to spur what some call an economic miracle. The future continues to hold great potential for participants in the electrical power industry, but a number of important challenges must be met in order for that potential to be fully realized. Demand for electricity continues to grow at a staggering rate, while concerns over the environmental impact of power generating facilities must not be ignored. As it becomes increasingly difficult to finance the rapid, and increasingly larger-scale expansion of the power industry through internal sources, the government must find resources to meet the growing demand at least cost. This will lead to important opportunities for the private sector. It is important, therefore, for those interested in participating in the power production industry and taking advantage of the newly emerging opportunities that lie in the Korean market, and elsewhere in Asia, to discuss the relevant issues and become informed of the specific conditions of each market.

23728 (CONF-9506115–7) **Decision-making in demand-side management collaboratives: The influence of non-utility parties on electric-utility policies and programs.** Schweitzer, M. (Oak Ridge National Lab., TN (United States)); English, M.; Schexnayder, S. Oak Ridge National Lab., TN (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 20. National Association of Environmental Professionals annual conference and exposition: environmental challenges - the next twenty years; Washington, DC (United States); 10-13 Jun 1995. Order Number DE95013977. Source: OSTI; NTIS; GPO Dep.

Since the late 1980s, a number of electric utilities and interested non-utility parties (NUPs)-such as environmental groups, large industrial customers, and state government agencies-have tried a new approach to reaching agreement on program design and policy issues related to utility use of Demand-Side Management (DSM) resources. Through this new arrangement, known as the DSM collaborative process, parties who have often been adversaries attempt to resolve their differences through compromise and consensus rather than by using traditional litigation. This paper-which is based on studies of over a dozen collaboratives nationwide-discusses the organizational structure of collaboratives, the ways in which NUPs have been involved in the decision-making process, and how the amount of influence exerted by the NUPs is related to collaborative accomplishments. Most of the collaboratives studied had two organizational levels: a "working group" that provided policy direction and guidance for the collaborative and "subgroups" that performed the detailed tasks necessary to flesh out individual DSM programs. Most collaboratives also had a coordinator who was charged with scheduling meetings, exchanging information, and performing other important organizational functions, and it was common for the utility to fund consultants to provide expert assistance for the NUPs. In general, the utilities reserved the final decision-making prerogative for themselves, in line with their ultimate responsibility to shareholders, customers, and regulators. Still, there was substantial variation among the collaboratives in terms of how actively consensus was sought and how seriously the inputs of the NUPs were taken. In general, the collaboratives that resulted in the largest effects on utility DSM usage were those in which the utilities were most willing to allow their decisions to be shaped by the NUPs.

23729 (DOE/EIA–0191(94)) **Cost and quality of fuels for electric utility plants, 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 14 Jul 1995. 170p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015577. Source: OSTI; NTIS; GPO; GPO Dep.

This document presents an annual summary of statistics at the national, Census division, State, electric utility, and plant levels regarding the quantity, quality, and cost of fossil fuels used to produce electricity. Purpose of this publication is to provide energy decision-makers with accurate, timely information that may be used in forming various perspectives on issues regarding electric power.

23730 (DOE/EIA–0226(95/06)) **Electric power monthly, June 1995 with data for March 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 19 Jun 1995. 185p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014402. Source: OSTI; NTIS; GPO; GPO Dep.

The Coal and Electric Data and Renewables Division; Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration (EIA), Department of Energy prepares the EPM. This publication provides monthly statistics at the State, Census division, and US levels for net generation, fossil fuel consumption and stocks, quantity and quality of fossil fuels, cost of fossil fuels, electricity sales, revenue, and average revenue per kilowatthour of electricity sold. Data on net generation, fuel consumption, fuel stocks, quantity and cost of fossil fuels are also displayed for the North American Electric Reliability Council (NERC) regions. The EIA publishes statistics in the EPM on net generation by energy source; consumption, stocks, quantity, quality, and cost of fossil fuels; and capability of new generating units by company and plant. 68 tabs.

23731 (DOE/EIA–M068(95)App.) **Documentation of the Electricity Market Module (EMM). Appendix, Model developers report.** USDOE Energy Information Administration, Washington, DC (United States). Energy Supply and Conversion Div. Feb 1995. 48p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014356. Source: OSTI; NTIS; GPO Dep.

The Office of Integrated Analysis and Forecasting (OIAF) is required to provide complete model documentation to meet the EIA Model Acceptance Standards. The Model Documentation for the Electricity Market Module (EMM) provides a complete description of the EMM methodology, structure, and relation to other modules in the National Energy Modeling System (NEMS). This Model Developers Report (MDR) serves as an appendix to the methodology documentation. The MDR provides an assessment of the sensitivity of the EMM results to changes in input data or parameters.

23732 (DOE/EIS–0182) **Energy planning and management program: Environmental impact statement.** USDOE Western Area Power Administration, Golden, CO (United States). [1995]. 310p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014997. Source: OSTI; NTIS; GPO Dep.

This environmental impact statement contains an analysis of the anticipated environmental impacts that would result from Western's proposed Energy Planning and Management Program. It contains a total of 13 alternatives, including a No-Action Alternative. All but the No-Action Alternative comprise different approaches to implementing the proposed Program. Except for the No-Action Alternative, relatively small distinctions were found in the impacts expected to result from the alternatives. However, there are important differences between the No-Action and other alternatives. The findings suggest that, in comparison with the No-Action Alternative, any of the Program Alternatives would result in fewer adverse environmental impacts over time. The analysis of economic impacts found that, in comparison to the No-Action Alternative, the Program Alternatives would be neutral or could improve regional economics. Western has established a Preferred Alternative that falls within the range of activities and impacts associated with the Program Alternatives. The Preferred Alternative is treated as a combination of Alternatives 5 and 6 and is not addressed separately.

23733 (ETDE-BR–0009) **Gradual addition planning of small-scale hydroelectric power plants to the generator park of a large scale electric power utility.** Demanboro, Antonio Carlos. Universidade Estadual de Campinas, SP (Brazil). Faculdade de Engenharia. 1990. 260p. (In Portugese). Order Number DE95789953. Source: OSTI; NTIS (US Sales Only).

A methodology for small-scale hydroelectric power plant installation in the interconnected concessionary, when the total capacity will be reduced in relation to the concessionary market is shown. The steps of this methodology are presented, according to the theoretical principles and the application criterion. A case report using this methodology is cited on detail. A forecast view of the Brazilian evolution for the several based elements in the electrical sector planning, as specified legislation, tariff system, market forecasts and plant projects optimization is also analyzed. 30 refs, 6 figs, 57 tabs

23734 (ETDE-BR–0015) **Criteria for determining the power supply among the electric power utilities.** Nasser, Ivana Costa. Universidade Estadual de Campinas, SP (Brazil). Faculdade de Engenharia Eletrica. Sep 1991. 101p. (In Portugese). Order Number DE95789959. Source: OSTI; NTIS (US Sales Only).

One of the objectives of the operation of an interconnected power system composed of several utilities is to determine energy and peak exchanges, in order to optimize the use of energy resources. In this way it is possible to provide a higher reliability to customers with lower costs. These exchanges are based on criteria which define the supply responsibility among the pooled participants. The supply responsibilities can be settled as firm contracts or temporary agreements. A new criterion for peak supply in a power pool is proposed, selected from seven alternative methods. In terms of methodology, six of the proposed criteria present a classical approach to the question, that is allocation of responsibilities. The seventh one, called 'direct determination of contracts', presents a different approach, characterizing the problem as a stochastic linear programming problem, solved by Monte Carlo Simulations and Benders Decomposition techniques. The results of an application are discussed The case study considers the south/southeast interconnected power system in Brazil, in its predicted configuration for December 1994. 35 refs, 14 figs, 23 tabs, 3 apps

23735 (ETDE-BR–0016) **Energetic parameters to be considered in the preparation of irrigation programs for the district of Santa Terezinha, Mato Grosso do Sul state, Brazil.** Alves, Claudio Benedito. UNESP, Botucatu, SP (Brazil). Faculdade de Ciencias Agronomicas. Dec 1990. 136p. (In Portugese). Order Number DE95789960. Source: OSTI; NTIS (US Sales Only).

In the elaboration of irrigation programs the characteristics of the region should be considered in order to identify the factors related to the local infrastructure, hydric resources and of the soils of the region and their interaction with the rural properties. Attention was given to the option between the use of electric power or diesel fuel in irrigation programs. The area studied was a hydro graphical micro basin in the district of Santa Terezinha, , Mato Grosso do Sul, Brazil. Rural properties with conditions to adopt techniques of irrigation and consumption of electric power were surveyed. Forms were used to collect data on: property and use of the land; knowledge of irrigation techniques and interest of the owner to be engaged in the program. The results show that 53.33% of them were interested in having their properties irrigated; 46.67% were not interested and 100% did not use irrigation techniques. Local conditions such as hydric resources and access to the power supply network were also evaluated. Factors that include the decision between the use of electric energy or diesel fuel in the irrigation program of the District of Santa Terezinha were studied. It was observed that the implantation of the irrigation program using electricity depends on the technical development of the electric power distribution system. For this region the resources to be invested in the irrigation system with 20, 50 and 75 HP diesel fuel motor are smaller when compared with electric power motors with the same potency. In 20 HP motors the expenses with electricity in irrigation systems are higher than the expenses with diesel fuel, and in 50 and 75 HP motors the expenses with diesel fuel are higher than the expenses with electricity. Considering the annual average expenses with energy, maintenance and depreciation of the equipment, the use of electric power limits to systems with 20 HP. (Abstract Truncated)

23736 (ETDE-DE–141) **Climate-compatible energy supply in Baden-Wuerttemberg. Electricity consumption of electronic data processing systems.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 7. Schulze, T. (Stuttgart Univ. (Germany). Inst. fuer Energiewirtschaft und Rationelle Energieanwendung (IER)); Fahl, U.; Voss, A. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 58p. (In German). Order Number DE95790284. Source: OSTI; NTIS (US Sales Only).

First of all, the equipment currently used (computers, screens, printers, etc.) in the office as well as its purpose and its energy consumption are reviewed in the context of a technology description. In the case of computers, there is a significant difference between operation and utilisaton patterns. Here, utilisation patterns should be analyzed for the individual technologies if sufficient data are available. In addition, it should be investigated inhowfar operation patterns reflect actual needs. This is the first instance in which energy savings are possible by technical and behavioural measures. After this, the present stock of electronic data processing equipment and its future diffusion should be assessed. This, together with the results on utilisation and electricity consuption, is a precondition for determining the aggregated electricity demand of electronic data processing applications. The importance of innovations for the development of the electronic data processing market is stressed throughout the report. Selective simulation is cited as another measure for rational energy use.

23737 (ETDE-DE–157) **Pilot project for investigating electric power conservation in municipal buildings. Final report.** Rath, U. (comp.). Hessisches Ministerium fuer Umwelt, Energie und Bundesangelegenheiten, Wiesbaden (Germany); Ingenieurbuero fuer Energieberatung, Haustechnik und Oekologische Konzepte GbR (EBOEK), Tuebingen (Germany). Mar 1995. 138p. (In German). Order Number DE95790731. Source: OSTI; NTIS (US Sales Only).

In order to permit a rapid survey of the most important aspects of the study, a summary informs on the ideas behind this pilot project, the selection of objects analyzed, the method adopted for analyzing power consumption, and essential results. Furthermore, a brief valuation is formulated. - The detailed main part covers the following: Different aspects relevant to the project are highlighted in the introduction. The course of the pilot investigations is described. A separate chapter is dedicated to the method of analysis used, because its systematics is not generally known. Then the results are reported and discussed. Finally, conclusions are drawn. The annex contains numerous tables. (orig./UA)

23738 (INIS-mf–15116) **Vereinigte Elektrizitaetswerke Westfalen AG. Annual report 1994.** Vereinigte Elektrizitaetswerke Westfalen AG (VEW), Dortmund (Germany). 1995. 96p. (In German). Order Number DE95790214. Source: OSTI; NTIS (US Sales Only); INIS.

The tasks and activities of this German electric utility are described. The annual report for 1994 contains a large number of financial data (e.g. balance sheet, profit- and -loss account, etc.). (UA)

2980 Consumption and Utilization

Refer also to citation(s) 23710, 23720, 23730, 23750

23739 (DOE/EIA–0035(95/06)) **Monthly energy review, June 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. Jun 1995. 174p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014485. Source: OSTI; NTIS; GPO; GPO Dep.

This is the June report by the Energy Information Administration. The contents of the report include an energy overview, energy consumption, petroleum, natural gas, oil and gas resource development, coal, electricity, nuclear energy, energy prices, and international energy. Included are appendices containing thermal conversion factors, metric and other physical conversion factors, and carbon dioxide emission factors for coal.

23740 (DOE/EIA–0214(93)) **State energy data report 1993: Consumption estimates.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. Jul 1995. 518p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015164. Source: OSTI; NTIS; GPO Dep.

The State Energy Data Report (SEDR) provides annual time series estimates of State-level energy consumption by major economic sector. The estimates are developed in the State Energy Data System (SEDS), which is maintained and operated by the Energy Information Administration (EIA). The goal in maintaining SEDS is to create historical time series of energy consumption by State that are defined as consistently as possible over time and across sectors. SEDS exists for two principal reasons: (1) to provide State energy consumption estimates to Members of Congress, Federal and State agencies, and the general public; and (2) to provide the historical series necessary for EIA's energy models.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 23720

23741 (ENEA-RT-ERG–95-02) **Some conditions for significant contribution from photovoltaics to sustainable development.** Coiante, D. (ENEA, Casaccia (Italy). Area Energia e Innovazione). ENEA, Casaccia (Italy). Area Energia e Innovazione. Mar 1994. 20p. Order Number DE95789773. Source: OSTI; NTIS (US Sales Only).

In medium-long term perspective, the anthropogenic atmospheric pollution, due to fossil fuel burning, could be contained by massively using of renewable energy. Significant improvements are expected to arise from diffusion into use of large scale PV power systems. Considering the situation in Italy as a typical study case, a limit can be individuated, which makes that PV contribution to annual electric energy balance can reach a maximum of about 7%. Such a figure corresponds to about 2% in terms of contribution to total energy balance. Thus, the intermittent energy sources are destined, in Italy, to be confined to a role, just significant (7%) in the electric energy sector, but quite marginal (2%) with reference to expected environmental massive benefits. Apart from numerical results, this disappointing concept can be applied in general to all OCSE countries, which globally produce the largest amount of world pollutant energy. Consequently, if photovoltaics wants to acquire a real environmental consistence, the limit of PV system diffusion has to be overcome. This can be attained by implementing the present grid-tied reference model for PV system diffusion by including an hydrogen production and storage system.

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

23742 (DOE/PC/79669–T3) **Conceptual design of a coal-fired MHD retrofit. Final technical report.** MHD Development Corp., Butte, MT (United States). Jun 1994. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79669. Order Number DE95015540. Source: OSTI; NTIS; GPO Dep.

Coal-fired magnetohydrodynamics (MHD) technology is ready for its next level of development - an integrated demonstration at a commercial scale. The development and testing of MHD has shown its potential to be the most efficient, least costly, and cleanest way to burn coal. Test results have verified a greater than 99% removal of sulphur with a potential for greater than 60% efficiency. This development and testing, primarily funded by the U.S. Department of Energy (DOE), has progressed through the completion of its proof-of-concept (POC) phase at the 50 MWt Component Development and Integration Facility (CDIF) and 28 MWt Coal Fired Flow Facility (CFFF), thereby, providing the basis for demonstration and further commercial development and application of the technology. The conceptual design of a retrofit coal-fired MHD generating plant was originally completed by the MHD Development Corporation (MDC) under this Contract, DE-AC22-87PC79669. Thereafter, this concept was updated and changed to a stand-alone MHD demonstration facility and submitted by MDC to DOE in response to the fifth round of solicitations for Clean Coal Technology. Although not selected, that activity represents the major interest in commercialization by the developing industry and the type of demonstration that would be eventually necessary. This report updates the original executive summary of the conceptual design by incorporating the results of the POC program as well as MDC's proposed Billings MHD Demonstration Project (BMDP) and outlines the steps necessary for commercialization.

3003 Thermoelectric Generators

23743 (DOE/SF/17905–T10) **Thermoelectric material development. Quarterly technical progress report, January 1, 1995–March 31, 1995.** Vandersande, J.W.; Caillat, T. Jet Propulsion Lab., Pasadena, CA (United States). [1995]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI02-89SF17905. Order Number DE95014298. Source: OSTI; NTIS; GPO Dep.

We have found that there is a limited range of solid solutions between the skutterudite compounds $CoSb_3$ and $RuSb_2Te$ (about 5% on each side). For the system $(RuSb_2Te)_x(CoSb_3)_{1-x}$, preliminary results obtained on one n-type sample on the $CoSb_3$-rich side show that these alloys have good thermoelectric properties and a maximum ZT of about 0.89 was obtained at about 600 C. More experiments will be started to investigate the possibility of a broader range of miscibility in this system which would allow an even further decrease in the lattice thermal conductivity, resulting in better thermoelectric properties. $IrSb_3$ and $RuSb_2Te$ form a complete range of solid solutions. Hot-pressed samples in this system have shown p-type conductivity. The thermoelectric properties of these p-type alloys have been measured and results have shown that their potential for thermoelectric applications is limited mainly because of the relatively low Seebeck coefficient values for p-type materials. Efforts will be directed on preparing n-type samples of the same alloys by doping with various dopants such as Ni and Pd.

3005 Fuel Cells

Refer also to citation(s) 23813, 23891, 23895

23744 (ANL–94/46) **European Fuel Cells R&D Review. Final report, Purchase Order No. 062014.** Michael, P.D. (Energy Technology Support Unit, Harwell (United Kingdom)); Maguire, J. Argonne National Lab., IL (United States); Energy Technology Support Unit, Harwell (United Kingdom). Sep 1994. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95014509. Source: OSTI; NTIS; GPO Dep.

Aim of the Review is to present a statement on the status of fuel cell development in Europe, addressing the research, development and demonstration (RD&D) and commercialization activities being undertaken, identifying key European organizations active in development and commercialization of fuel cells and detailing their future plans. This document describes the RD&D activities in Europe on alkaline, phosphoric acid, polymer electrolyte, direct methanol, solid oxide, and molten carbonate fuel cell types. It describes the European Commission's activities, its role in the European development of fuel cells, and its interaction with the national programs. It then presents a country-by-country breakdown. For each country, an overview is given, presented by fuel cell type. Scandinavian countries are covered in less detail. American organizations active in Europe, either in supplying fuel cell components, or in collaboration, are identified. Applications include transportation and cogeneration.

23745 (ANL/CMT/CP–85790) **Fuel cell systems for first lunar outpost – Reactant storage options.** Nelson, P.A. (Argonne National Lab., IL (United States). Chemical Technology Div.). Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505226–1: 4. space electrochemical research

and technology conference, Cleveland, OH (United States), 2-3 May 1995). Order Number DE95013408. Source: OSTI; NTIS; GPO Dep.

A Lunar Surface Power Working Group was formed to review candidate systems for providing power to the First Lunar Outpost habitat. The working group met for five days in the fall of 1992 and concluded that the most attractive candidate included a photovoltaic unit, a fuel cell, a regenerator to recycle the reactants, and storage of oxygen and hydrogen gases. Most of the volume (97%) and weight (64%) are taken up by the reactants and their storage tanks. The large volume is difficult to accommodate, and therefore, the working group explored ways of reducing the volume. An alternative approach to providing separate high pressure storage tanks is to use two of the descent stage propellant storage tanks, which would have to be wrapped with graphite fibers to increase their pressure capability. This saves 90% of the volume required for storage of fuel cell reactants. Another approach is to use the descent storage propellant tanks for storage of the fuel cell reactants as cryogenic liquids, but this requires a gas liquefaction system, increases the solar array by 40%, and increases the heat rejection rate by 170% compared with storage of reactants as high pressure gases. For a high power system (>20 kW) the larger energy storage requirement would probably favor the cryogenic storage option.

23746 (LA-UR–95-1351) **Through-the-electrode model of a proton exchange membrane fuel cell with independently measured parameters.** Weisbrod, K.R.; Grot, S.A.; Vanderborgh, N.E. Los Alamos National Lab., NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-951007–2: 188. meeting of the Electrochemical Society, Chicago, IL (United States), 8-13 Oct 1995). Order Number DE95012063. Source: OSTI; NTIS; GPO Dep.

A one dimensional model for a proton exchange membrane fuel cell was developed which makes use of independently measured parameters for predicting single cell performance. Optimization of catalyst layer formulation and properties are explored. Impact of temperature and cathode pressure upon system performance was investigated.

23747 (LA-UR–95-1352) **Characterization of PEM fuel cell membrane-electrode-assemblies by electrochemical methods and microanalysis.** Borup, R.L.; Vanderborgh, N.E. Los Alamos National Lab., NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-951007–1: 188. meeting of the Electrochemical Society, Chicago, IL (United States), 8-13 Oct 1995). Order Number DE95012064. Source: OSTI; NTIS; GPO Dep.

Hydrogen adsorption/desorption and CO oxidation are used to evaluate the active Pt surface area of fuel cell membrane electrode assemblies. The membrane electrode assemblies are evaluated for useful catalyst life and are examined for relative CO and CO_2 tolerance. The electrochemical measurements combined with microanalysis of membrane electrode assemblies, including SEM and EDS allow a greater understanding and optimization of process variables.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

Refer also to citation(s) 23031, 23035, 23036, 23037, 23038, 23039, 23041, 23703

23748 (DOE/EE–0064) **Technical support document: Energy efficiency standards for consumer products: Refrigerators, refrigerator-freezers, and freezers including draft environmental assessment, regulatory impact analysis.** USDOE Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC (United States). Office of Codes and Standards. Jul 1995. 416p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015578. Source: OSTI; NTIS; GPO Dep.

The Energy Policy and Conservation Act (P.L. 94-163), as amended by the National Appliance Energy Conservation Act of 1987 (P.L. 100-12) and by the National Appliance Energy Conservation Amendments of 1988 (P.L. 100-357), and by the Energy Policy Act of 1992 (P.L. 102-486), provides energy conservation standards for 12 of the 13 types of consumer products' covered by the Act, and authorizes the Secretary of Energy to prescribe amended or new energy standards for each type (or class) of covered product. The assessment of the proposed standards for refrigerators, refrigerator-freezers, and freezers presented in this document is designed to evaluate their economic impacts according to the criteria in the Act. It includes an engineering analysis of the cost and performance of design options to improve the efficiency of the products; forecasts of the number and average efficiency of products sold, the amount of energy the products will consume, and their prices and operating expenses; a determination of change in investment, revenues, and costs to manufacturers of the products; a calculation of the costs and benefits to consumers, electric utilities, and the nation as a whole; and an assessment of the environmental impacts of the proposed standards.

23749 (DOE/EE–0066) **Partnerships for technology introduction – Putting the technologies of tomorrow into the marketplace of today. Report to Congress on Sections 127 and 128 of the Energy Policy Act of 1992.** USDOE Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC (United States). Building Equipment Div. Apr 1995. 28p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016234. Source: OSTI; NTIS; GPO Dep.

This report to Congress was prepared on behalf of the Secretary of the US Department of Energy (DOE) in response to Sections 127 and 128 of the Energy Policy Act of 1992 (EPAct), Pub. L. 102-486. In preparing the report to the Congress, DOE has assessed the national and regional energy savings potential of products already on the market and those that will be available to consumers by the late 1990s. The Department has also examined the present cost-effectiveness of these emerging appliances as mature technologies. To help in its assessment, DOE organized eight workshops at which representatives from manufacturing and building industries, utilities, retailers and wholesalers, public interest groups and Federal and state government agencies could express their views. The information derived from these workshops was key to the formulation of the report's general and specific recommendations. DOE has concluded that the Federal Government can effectively stimulate the market for emerging technologies by forming partnerships with the appliance industry and other interested parties promoting the use of highly efficient appliances. Based on the interaction with industry at the eight workshops and through direct contact, DOE has concluded that Federal action and technical assistance is not only desired by industry, but crucial to the expansion of these markets. Section 128 of EPAct requires an assessment of the energy savings and environmental benefits of replacing older, less efficient appliances with more efficient products than currently required by Federal law. Since early replacement of appliances is but one possible market-stimulating action, DOE has elected to include its discussion as part of the overall report to the Congress.

23750 (DOE/EIA–0314(93)) **Housing characteristics 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. Jun 1995. 355p. Sponsored by USDOE, Washington, DC (United States). US Department of Health and Human Services; USDOE Office of Mino Order Number DE95014557. Source: OSTI; NTIS; GPO Dep.

This report, Housing Characteristics 1993, presents statistics about the energy-related characteristics of US households. These data were collected in the 1993 Residential Energy Consumption Survey (RECS) – the ninth in a series of nationwide energy consumption surveys conducted since 1978 by the Energy Information Administration of the US Department of Energy. Over 7 thousand households were surveyed, representing 97 million households nationwide. A second report, to be released in late 1995, will present statistics on residential energy consumption and expenditures.

23751 (DOE/GO/10044–1) **The harmonization of Canadian and U.S. window programs and standards. Final report.** Enermodal Engineering, Inc., Denver, CO (United States). 31 May 1995. 192p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG36-94GO10044. Order Number DE95015479. Source: OSTI; NTIS; GPO Dep.

The window and door industry in North America have a strong interest in harmonizing US and Canadian rating procedures and standards for predicting the thermal performance of their products. The costs and time associated with complying with the requirements in both countries are significant and could be reduced through reciprocity. The purpose of this paper is to compare the US and Canadian rating programs. Joint efforts between the US and Canada can use this information to focus on reconciling the differences and to work towards reciprocity. The following identifies the applicable procedures and standards for both countries, and summarizes the major differences in the products that are covered, the sizes that are used, the U-factor and solar heat gain coefficient calculational and test methods, air leakage measurement, prediction of annual energy use, condensation resistance methods, reporting requirements, and accreditation and certification programs. The major differences between the system s are identified and recommendations are made to achieve reciprocity. The appendix contains a paper that is a synopsis of the findings from this study.

23752 (DOE/ID/13052–1) **New industrial heat pump applications to a synthetic rubber plant. Final report, Phase IIA.** TENSA Services, Houston, TX (United States). 1993. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC02-91ID13052. Order Number DE95015481. Source: OSTI; NTIS; GPO Dep.

This report summarizes the results of the Phase IIA of the DOE sponsored study titled, Advanced Industrial Heat Pump Application and Evaluation. The scope of this phase of the study was to finalize the process design of the heat pump scheme, develop a process and instrumentation diagram, and a detailed cost estimate for the project. This information is essential for the site management to evaluate the economic viability and operability of the proposed heat pump design, prior to the next phase of installation and testing.

23753 (DOE/R2/15469–T8) **The recuperator of flue gas heat. Final report.** Thermecon, Champlain, NY (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG42-93R215469. Order Number DE95015458. Source: OSTI; NTIS; GPO Dep.

The performance of a recuperator with respect to lowering the exiting temperature of flue gas has been evaluated. The recuperator lowered the flue gas temperature and increased the output heating capacity, thereby increasing the efficiency of fuel utilization. The recuperator could improve the efficiency of older, existing furnaces.

23754 (DOE/R4/10610–T1) **Energy efficient affordable housing. Final report.** Southface Energy Inst., Inc., Atlanta, GA (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG44-93R410610. Order Number DE95015454. Source: OSTI; NTIS; GPO Dep.

In 1994, the Southface Energy Institute, working with support from US DOE, initiated a program to provide technical assistance to nonprofit organizations developing affordable housing in the Olympic target communities of Atlanta. The specific project goals were: Identify the barriers that nonprofit affordable housing providers face in increasing the energy and resource efficiency of affordable housing; Assist them in developing the resources to overcome these barriers; Develop specific technical materials and program models that will enable these affordable housing groups to continue to improve the energy efficiency of their programs; and, To transfer the program materials to other affordable housing providers. This report summarizes the progress made in each of these areas.

23755 (ETDE-DE–150) **Development of novel dynamic latent heat storage processes.** Biedermann, A. HLB Institut fuer Heizung, Lueftung und Bautechnik, Berlin (Germany). Jan 1995. 106p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0329219A. Order Number DE95790709. Source: OSTI; NTIS (US Sales Only).

The report describes novel, efficient latent heat storage systems with high energy densities. The storage systems will be used in the space and water heating sector. The investigations comprised two fields of emphasis, i.e. temperatures of 50-80 C and 110-130 C. Further chapters discuss economic aspects and potential applications. (HW)

23756 (ETDE-DE–164) **Climate-compatible energy supply in Baden-Wuerttemberg. Potential energy savings in the building construction sector in Baden-Wuerttemberg.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 8. Gierga, M. (Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany)); Erhorn, H. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 79p. (In German). Order Number DE95790281. Source: OSTI; NTIS (US Sales Only).

This brochure is part of the progress reports of the "Academy for Technology Assessment in Baden-Wuerttemberg". It reviews the project "Climate-compatible energy supply in Baden-Wuerttemberg". Options for a restructuring of the energy supply and energy consumption systems are analyzed with the goal of a 25-30% reduction of CO_2 emissions by the year 2005. Contents: State of the art; Technical potential; Energy consumption; Potential energy savings; Investment cost. (orig.)

23757 (ETDE-DE–168) **Thermal insulation materials for buildings. Catalogue of standardized products accepted by the building authorities.** Sauerbrunn, I. Gesamtverband Daemmstoffindustrie (GDI), Hamburg (Germany). [1995]. 28p. (In German). Order Number DE95790560. Source: OSTI; NTIS (US Sales Only).

The brochure lists standardized products for thermal insulation of buildings which have been accepted by the building authorities. Contents: Standards for thermal insulation of buildings; application types; organic insulating materials; inorganic insulating materials; properties of insulating materials; labelling; quality assurance and monitoring. (orig.)

23758 (NYSERDA–95-10) **Office technology energy use and savings potential in New York. Final report.** New York State Energy Research and Development Authority, Albany, NY (United States); Lawrence Berkeley Lab., CA (United States). Jun 1995. 90p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223 (United States).

This report discusses energy use by office equipment in New York State and the energy savings potential of energy-efficient equipment. A model containing equipment densities and energy-use characteristics for major categories of office equipment has been developed. The model specifies power requirements and hours of use for three modes of average operation for each device: active, standby, and suspend. The energy-use intensity for each device is expressed as a function of the average device density (number of units/1,000 sq ft), the hours of operation in each mode, and the average power requirements in each mode. Output includes an estimate of total energy use (GWh) for each device by building type. Three scenarios are developed. First is a business-as-usual efficiency baseline. Second is a future with increased use of power-managed devices projected under the current Energy Star Computers program sponsored by the US EPA. Third is a scenario that examines energy savings from greater use of products that go well beyond the standard Energy Star products. A series of sensitivity analyses were conducted to explore uncertainties in model inputs. The business-as-usual baseline forecast confirms that office equipment energy use has been rising over the past decade, and may continue to increase for the next decade and beyond. Office equipment currently consumes about 2,900 GWh/year in the State of New York. Under the business-as-usual baseline forecast, this load may increase to 3,300 GWh/year by the year 2000, and approximately double again before 2010. Widespread use of power management technologies adopted with the promotion of the Energy Star program could reduce this load growth by about 30% by the year 2000. Use of more advanced energy-efficient technology

could reduce total energy use by office equipment to about 1,900 GWh/year in 2010, which is less than current consumption.

23759 (ORNL/CON–412) **Evaluating the income and employment impacts of gas cooling technologies.** Hughes, P.J. (Oak Ridge National Lab., TN (United States)); Laitner, S. Oak Ridge National Lab., TN (United States). Mar 1995. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95012543. Source: OSTI; NTIS; GPO Dep.

The purpose of this study is to estimate the potential employment and income benefits of the emerging market for gas cooling products. The emphasis here is on exports because that is the major opportunity for the U.S. heating, ventilating, and air-conditioning (HVAC) industry. But domestic markets are also important and considered here because without a significant domestic market, it is unlikely that the plant investments, jobs, and income associated with gas cooling exports would be retained within the United States. The prospects for significant gas cooling exports appear promising for a variety of reasons. There is an expanding need for cooling in the developing world, natural gas is widely available, electric infrastructures are over-stressed in many areas, and the cost of building new gas infrastructure is modest compared to the cost of new electric infrastructure. Global gas cooling competition is currently limited, with Japanese and U.S. companies, and their foreign business partners, the only product sources. U.S. manufacturers of HVAC products are well positioned to compete globally, and are already one of the faster growing goods-exporting sectors of the U.S. economy. Net HVAC exports grew by over 800 percent from 1987 to 1992 and currently exceed $2.6 billion annually (ARI 1994). Net gas cooling job and income creation are estimated using an economic input-output model to compare a reference case to a gas cooling scenario. The reference case reflects current policies, practices, and trends with respect to conventional electric cooling technologies. The gas cooling scenario examines the impact of accelerated use of natural gas cooling technologies here and abroad.

23760 (ORNL/SUB–91-SH225) **Technology assessment of external heat systems for Stirling heat pumps. Final report.** Vasilakis, A.D. (Advanced Mechanical Technology, Inc., Newton, MA (United States)). Oak Ridge National Lab., TN (United States); Advanced Mechanical Technology, Inc., Newton, MA (United States). Dec 1993. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011624. Source: OSTI; NTIS; GPO Dep.

A technology assessment and design improvement effort was undertaken for the Stirling engine heat pump external heat system (EHS) in order to reduce costs. It was found that only two applicable EHS design approaches have been developed to any extent: a relatively undeveloped design featuring a premixed fuel and air transpiration burner, and a turbulent diffusion type burner system developed by Mechanical Technology, Inc. To evaluate and optimize the design concepts, an analytical model was developed that examined design and performance variables. The model calculated key temperatures, allowing the specification of materials requirements. Adherence to American National Standards Institute appliance furnace code material specifications was assumed. Concepts for EHS control systems were evaluated, and a cost-effective control system design was developed for the turbulent diffusion burner EHS. The study reveals that optimizing the diffusion burner EHS design can result in significant cost savings. No clear choice between the diffusion burner and transpiration burner systems could be determined from this study, but the designs of both were further developed and improved. Estimates show the EHS based on a transpiration burner to have a manufactured cost that is roughly 70% of the turbulent diffusion burner EHS cost, but fuel efficiency is lower by about 18%.

23761 (PNL–10541) **FORSCOM installation characterization and ranking for water efficiency improvement.** Fitzpatrick, Q.K. (and others); McMordie, K.L.; Di Massa, F.V. Pacific Northwest Lab., Richland, WA (United States). May 1995. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015135. Source: OSTI; NTIS; GPO Dep.

On March 11, 1994, President Clinton signed Executive Order 12902-Energy Efficiency and Water Conservation at Federal Facilities. Section 302 of the Executive Order calls for energy and water prioritization surveys of federal facilities to be conducted. The surveys will be used to establish priorities for conducting comprehensive facility audits. In response to the requirements of the Executive Order, the U.S. Army Forces Command (FORSCOM) has tasked Pacific Northwest Laboratory (PNL) to initiate a broad study of the water savings potential at each of its major installations. This report provides an assessment of the water, sewer, energy (for hot water production and pumping), and associated cost savings potential at ten of the major FORSCOM installations. This assessment is meant to be a "first pass" estimate of the water savings potential, to assist FORSCOM in prioritizing installations for detailed water audits and potential water efficient retrofits. In addition, the end uses (toilets, sinks, showerheads, irrigation, etc.) with the greatest water savings potential are identified at each installation. This report is organized in the following manner. Following this Introduction, Section 2 provides important background information pertaining to the water analysis. Section 3 describes the methodology employed in the analysis, and Section 4 summarizes the study results. Section 5 prioritizes the installations based on both water/sewer savings and cost associated with water, sewer, and energy savings. Section 6 provides recommendations on where to start detailed water audits, as well as other recommendations. References are listed in Section 7. The appendices provide specific information on the analysis results and methodology, along with a discussion of special issues.

23762 (PNL-SA–26005) **Maintaining the solution to operations and maintenance efficiency improvement.** Meador, R.J. Pacific Northwest Lab., Richland, WA (United States). May 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950564–10: 9. symposium on power plant dynamics, control and testing, Knoxville, TN (United States), 24-26 May 1995). Order Number DE95014610. Source: OSTI; NTIS; GPO Dep.

This paper discusses the emergence of a new, necessary philosophy for the successful implementation of advanced technologies to improve plant performance and longevity. Thus philosophy is necessary to ensure the expected return on the initial capital investment is realized. This paper defines the elements of an Operations and Maintenance (O&M) methodology that utilizes a holistic approach which considers all aspects of the supporting infrastructure (Operations, Maintenance, Engineering, Training, and Administration) as integral parts of the whole system. This paper also discusses a network structure that provides an intelligent integrated plant communication network for the measurement and management of plant performance goals.

3202 Transportation

Refer also to citation(s) 23812, 23815

23763 (ANL/RA/CP–85716) **Large-scale Intelligent Transporation Systems simulation.** Ewing, T.; Canfield, T.; Hannebutte, U.; Levine, D.; Tentner, A. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950439–13: SMS simulation multiconference: simulation as a critical technology, Phoenix, AZ (United States), 9-13 Apr 1995). Order Number DE95012268. Source: OSTI; NTIS; GPO Dep.

A prototype computer system has been developed which defines a high-level architecture for a large-scale, comprehensive, scalable simulation of an Intelligent Transportation System (ITS) capable of running on massively parallel computers and distributed (networked) computer systems. The prototype includes the modelling of instrumented "smart" vehicles with in-vehicle navigation units capable of optimal route planning and Traffic Management Centers (TMC). The TMC has probe vehicle tracking capabilities (display position and attributes of instrumented vehicles), and can provide 2-way interaction with traffic to provide advisories and link times. Both the in-vehicle navigation module and the TMC feature detailed graphical user interfaces to support human-factors studies.

The prototype has been developed on a distributed system of networked UNIX computers but is designed to run on ANL's IBM SP-X parallel computer system for large scale problems. A novel feature of our design is that vehicles will be represented by autonomus computer processes, each with a behavior model which performs independent route selection and reacts to external traffic events much like real vehicles. With this approach, one will be able to take advantage of emerging massively parallel processor (MPP) systems.

23764 (CONF-950193–2) **A restricted branch and bound approach for setting the left turn phase sequences in signalized networks.** Pillai, R.S. (Oak Ridge National Lab., TN (United States)); Rathi, A.K.; Cohen, S. Oak Ridge National Lab., TN (United States). Jul 1994. 19p. Sponsored by Federal Highway Administration, Washington, DC (United States). DOE Contract AC05-84OR21400. From 74. annual transportation research board meeting; Washington, DC (United States); 11-15 Jan 1995. Order Number DE95014286. Source: OSTI; NTIS; GPO Dep.

The main objective of synchronized signal timing is to keep traffic moving along arterial in platoons throughout the signal system by proper setting of left turn phase sequence at signals along the arterials/networks. The synchronization of traffic signals located along the urban/suburban arterials in metropolitan areas is perhaps one of the most cost-effective method for improving traffic flow along these streets. The popular technique for solving this problem formulates it as a mixed integer linear program and used Land and Powell branch and bound search to arrive at the optimal solution. The computation time tends to be excessive for realistic multiarterial network problems due to the exhaustive nature of the branch and bound search technique. Furthermore, the Land and Powell branch and bound code is known to be numerically unstable, which results in suboptimal solutions for network problems with a range on the cycle time variable. This paper presents the development of a fast and numerically stable heuristic, developed using MINOS linear programming solver. The new heuristic can generate optimal/near-optimal solutions in a fraction of the time needed to compute the optimal solution by Land and Powell code. The solution technique is based on restricted search using branch and bound technique. The efficiency of the heuristic approach is demonstrated by numerical results for a set of test problems.

23765 (CONF-9504177–1) **Panama Canal capacity analysis.** Bronzini, M.S. (Oak Ridge National Lab., Knoxville, TN (United States). Center for Transportation Analysis). Oak Ridge National Lab., TN (United States). 27 Apr 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From The new Panama Canal: another path between the seas; New York, NY (United States); 27 Apr 1995. Order Number DE95013993. Source: OSTI; NTIS; GPO Dep.

Predicting the transit capacities of the various Panama Canal alternatives required analyzing data on present Canal operations, adapting and extending an existing computer simulation model, performing simulation runs for each of the alternatives, and using the simulation model outputs to develop capacity estimates. These activities are summarized in this paper. A more complete account may be found in the project final report (TAMS 1993). Some of the material in this paper also appeared in a previously published paper (Rosselli, Bronzini, and Weekly 1994).

23766 (ETDE-DE–167) **Climate-compatible energy supply in Baden-Wuerttemberg. Energy savings and CO_2 reduction in transportation - how to reduce private transportation, induce people to use environment-friendly means of transportation, and enhance the network capacity.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 20. Steierwald, G. (Stuttgart Univ. (Germany). Inst. fuer Strassen- und Verkehrswesen); Flasche, B.; Kolb, A.; Lampatzer, R.; Moergenthaler, U.; Vogt, W. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 130p. (In German). Order Number DE95790272. Source: OSTI; NTIS (US Sales Only).

This brochure is one of the progress reports of the "Academy for Technology Assessment in Baden-Wuerttemberg". Expert's opinion No.15, "Energy conservation and CO_2 reduction in transportation - how to reduce private transportation, induce people to use environment-friendly means of transportation, and enhance the network capacity" investigated strategies and measures for reducing energy consumption and CO_2 emissions on the transportation sector; the report contains 15 studies on the following subjects: How to reduce the number of motor cars on the roads; How to induce people to use less polluting means of transportation; How to enhance the network frequency. (HW)

23767 (LA-UR–95-1641) **TRANSIMS: Transportation analysis and simulation system.** Smith, L. (and others); Beckman, R.; Baggerly, K. Los Alamos National Lab., NM (United States). [1995]. 10p. Sponsored by Department of Transportation, Washington, DC (United States);Environmental Protection Agency, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015335. Source: OSTI; NTIS; GPO Dep.

This document summarizes the TRansportation ANalysis and SIMulation System (TRANSIMS) Project, the system's major modules, and the project's near-term plans. TRANSIMS will employ advanced computational and analytical techniques to create an integrated regional transportation systems analysis environment. The simulation environment will include a regional population of individual travelers and freight loads with travel activities and plans, whose individual interactions will be simulated on the transportation system, and whose environmental impact will be determined. We will develop an interim operational capability (IOC) for each major TRANSIMS module during the five-year program. When the IOC is ready, we will complete a specific case study to confirm the IOC features, applicability, and readiness.

23768 (SAND–94-2328/2) **Research methods to develop Measures of Effectiveness of the United States Coast Guard's Vessel Inspection and Boarding Program. Volume 2, Main report.** Wheeler, T. (Sandia National Labs., Albuquerque, NM (United States)); Cox, R.; Gawande, K.; Stone, R.; Waisel, L.; Wallace, W.A. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 657p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014528. Source: OSTI; NTIS; GPO Dep.

The primary objective of this study is to provide Measures of Effectiveness (MOEs) of the US Coast Guard Marine Inspection and Boarding Program based on objective scientific methods. A secondary objective of the study is to provide USCG management with a methodologically and theoretically sound aid to effective policy decision-making. The MOEs constructed in this study are specific to the Marine Inspection and Boarding Program, but the methodology of the study is based on sound theoretical principles that are probably applicable to a range of USCG activities. Hence the methodology applied equally to other important USCG programs and can be similarly used to measure their effectiveness and as an aid to decision-making.

23769 (SAND–95-0867) **The state-of-the-art port of entry workshop.** Godfrey, B. Sandia National Labs., Albuquerque, NM (United States). May 1995. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9407186–Exec.Summ.: State-of-the-art port of entry workshop, Albuquerque, NM (United States), 14-15 Jul 1994). Order Number DE95013558. Source: OSTI; NTIS; GPO Dep.

The increased demand for freight movements through international ports of entry and the signing of the North American Free Trade Agreement (NAFTA) have increased freight traffic at border ports of entry. The State-of-the-Art Port of Entry Workshop initiated a dialogue among technologists and stakeholders to explore the potential uses of technology at border crossings and to set development priorities. International ports of entry are both information and labor intensive, and there are many promising technologies that could be used to provide timely information and optimize inspection resources. Participants universally held that integration of technologies and operations is critical to improving port services. A series of Next Steps was developed to address stakeholder issues and national priorities, such as the National Transportation Policy and National Drug Policy. This report documents the views of the various stakeholders and technologists present at the workshop and outlines future directions of study.

23770 (SAND–95-1268) **The pulsed linear induction motor concept for high-speed trains.** Turman, B.N.; Marder, B.M.; Rohwein, G.J.; Aeschliman, D.P.; Kelley, J.B.; Cowan, M.; Zimmerman, R.M. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014531. Source: OSTI; NTIS; GPO Dep.

The SERAPBIM (SEgmented RAil PHased Induction Motor) concept is a linear induction motor concept which uses rapidly-pulsed magnetic fields and a segmented reaction rail, as opposed to low-frequency fields and continuous reaction rails found in conventional linear induction motors. These improvements give a high-traction, compact, and efficient linear motor that has potential for advanced high speed rail propulsion. In the SERAPBIM concept, coils on the vehicle push against a segmented aluminum rail, which is mounted on the road bed. Current is pulsed as the coils cross an edge of the segmented rail, inducing surface currents which repel the coil. The coils must be pulsed in synchronization with the movement by reaction rail segments. This is provided by a sense-and-fire circuit that controls the pulsing of the power modulators. Experiments were conducted to demonstrate the feasibility of the pulsed induction motor and to collect data that could be used for scaling calculations. A 14.4 kg aluminum plate was accelerated down a 4 m track to speeds of over 15 m/sec with peak thrust up to 18 kN per coilset. For a trainset capable of 200 mph speed, the SERAPHIM concept design is based on coils which are each capable of producing up to 3.5 kN thrust, and 30 coil pairs are mounted on each power car. Two power cars, one at each end of the train, provide 6 MW from two gas turbine prime power units. The thrust is about 210.000 N and is essentially constant up to 200 km/hr since wheel slippage does not limit thrust as with conventional wheeled propulsion. A key component of the SERAPHIM concept is the use of passive wheel-on-rah support for the high speed vehicle. Standard steel wheels are capable of handling over 200 mph. The SERAPHIM cost is comparable to that for steel-wheel high-speed rail, and about 10% to 25% of the projected costs for a comparable Maglev system.

23771 (UCRL-ID–121357) **Analysis of automated highway system risks and uncertainties. Volume 5.** Sicherman, A. Lawrence Livermore National Lab., CA (United States). Oct 1994. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015595. Source: OSTI; NTIS; GPO Dep.

This volume describes a risk analysis performed to help identify important Automated Highway System (AHS) deployment uncertainties and quantify their effect on costs and benefits for a range of AHS deployment scenarios. The analysis identified a suite of key factors affecting vehicle and roadway costs, capacities and market penetrations for alternative AHS deployment scenarios. A systematic protocol was utilized for obtaining expert judgments of key factor uncertainties in the form of subjective probability percentile assessments. Based on these assessments, probability distributions on vehicle and roadway costs, capacity and market penetration were developed for the different scenarios. The cost/benefit risk methodology and analysis provide insights by showing how uncertainties in key factors translate into uncertainties in summary cost/benefit indices.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 22997, 23423, 23515, 23653, 23692, 23715, 23752, 23804, 23805, 23943, 23969, 24055, 24423, 24424, 24443

23772 (ANL/DIS/RP–85600) **Hazardous waste management in the Pacific basin.** Cirillo, R.R. (Argonne National Lab., IL (United States)); Chiu, S.; Chun, K.C.; Conzelmann, G.; Carpenter, R.A.; Indriyanto, S.H. Argonne National Lab., IL (United States); East-West Center, Honolulu, HI (United States). Nov 1994. 206p. Sponsored by U.S. Trade and Development Agency, Rosslyn, VA (United States). DOE Contract W-31109-ENG-38. Order Number DE95014658. Source: OSTI; NTIS; GPO Dep.

Hazardous waste control activities in Asia and the Pacific have been reviewed. The review includes China (mainland, Hong Kong, and Taiwan), Indonesia, Korea, Malaysia, Papua New Guinea, the Philippines, Singapore, and Thailand. It covers the sources of hazardous waste, the government structure for dealing with hazardous waste, and current hazardous waste control activities in each country. In addition, the hazardous waste program activities of US government agencies, US private-sector organizations, and international organizations are reviewed. The objective of these reviews is to provide a comprehensive picture of the current hazardous waste problems and the waste management approaches being used to address them so that new program activities can be designed more efficiently.

23773 (ANL/ES/CP–82597) **Recycling zinc by dezincing steel scrap.** Dudek, F.J. (Argonne National Lab., IL (United States)); Daniels, E.J.; Morgan, W.A. Argonne National Lab., IL (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505131–1: International symposium on the extraction and applications of zinc and lead, Sendai (Japan), 22-24 May 1995). Order Number DE95013469. Source: OSTI; NTIS; GPO Dep.

In response to the worldwide increase in consumption of galvanized steel for automobiles in the last fifteen years, and the increased cost of environmental compliance associated with remelting larger quantities of galvanized steel scrap, a process is being developed to separate and recover the steel and zinc from galvanized ferrous scrap. The zinc is dissolved from the scrap in hot caustic using anodic assistance and is recovered electrolytically as dendritic powder. The designed ferrous scrap is rinsed and used directly. The process is effective for zinc, lead, and aluminum removal on loose and baled scrap and on all types of galvanized steel. The process has been pilot tested in Hamilton, Ontario for batch treatment of 900 tonnes of mostly baled scrap. A pilot plant in East Chicago, Indiana has designed in a continuous process mode 900 tonnes of loose stamping plant scrap; this scrap typically has residual zinc below 0.1% and sodium dragout below 0.001%. This paper reviews pilot plant performance and the economics of recycling galvanized steel and recovering zinc using a caustic process.

23774 (ANL/ET/CP–85947) **Simulation of fluid flow induced by opposing ac magnetic fields in a continuous casting mold.** Chang, F.C. (Argonne National Lab., IL (United States)); Hull, J.R.; Beitelman, L. Argonne National Lab., IL (United States). [1995]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9504182–1: 78. steelmaking and 54. ironmaking conference, Nashville, TN (United States), 2-5 Apr 1995). Order Number DE95013764. Source: OSTI; NTIS; GPO Dep.

A numerical simulation was performed for a novel electromagnetic stirring system employing two rotating magnetic fields. The system controls stirring flow in the meniscus region of a continuous casting mold independently from the stirring induced within the remaining volume of the mold by a main electromagnetic stirrer (M-EMS). This control is achieved by applying to the meniscus region an auxiliary electromagnetic field whose direction of rotation is opposite to that of the main magnetic field produced by the M-EMS. The model computes values and spatial distributions of electromagnetic parameters and fluid flow in the stirred pools of mercury in cylindrical and square geometries. Also predicted are the relationships between electromagnetics and fluid flows pertinent to a dynamic equilibrium of the opposing stirring swirls in the meniscus region. Results of the numerical simulation compared well with measurements obtained from experiments with mercury pools.

23775 (CONF-9504123–1) **Solvent-free cleaning using a centrifugal cryogenic pellet accelerator.** Haines, J.R.; Fisher, P.W.; Foster, C.A. Oak Ridge National Lab., TN (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Innovative concepts technology and business opportunities; Denver, CO (United States); 20-21 Apr 1995. Order Number DE95013041. Source: OSTI; NTIS; GPO Dep.

An advanced centrifuge that accelerates frozen CO_2 pellets to high speeds for surface cleaning and paint removal is being developed at the Oak Ridge National Laboratory. The centrifuge-based accelerator was designed, fabricated, and tested under a program sponsored by the Warner Robins Air Logistics Center, Robins Air

Force Base, Georgia. In comparison to the more conventional compressed air "sandblast" pellet accelerators, the centrifugal accelerator system can achieve higher pellet speeds, has precise speed control, and is more than ten times as energy efficient. Furthermore, the use of frozen CO_2 pellets instead of conventional metal, plastic, sand, or other abrasive materials that remain solid at room temperature, minimizes the waste stream. This apparatus has been used to demonstrate cleaning of various surfaces, including removal of paint, oxide coatings, metal coatings, organic coatings, and oil and grease coatings from a variety of surfaces. The design and operation of the apparatus is discussed.

23776 (CRIE-W–94004) **Development of two-stage compression heat pump for hot water supply in commercial use. Demonstrated performance of a system applied with vertical shell and tube multifunction intermediate heat exchanger.** Hasegawa, H. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Saikawa, M.; Hashimoto, K.; Mimaki, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Aug 1994. 49p. (In Japanese). Order Number DE95790556. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

The performance of a multifunction intermediate heat exchanger system was verified for the purpose of developing a high performance heat pump. Since a pressure rise was obtained by two compressors of a low stage and a high stage, the discharge pressure on the high stage side was able to be set high, enabling a high temperature hot water supply at 65°C. The feedwater of 10°C or so was preheated to 30 to 40°C with a low condensation temperature refrigerant that was partially condensed through an intermediate heat exchanger; the feedwater was further heated through a cascade heating up to 65°C with a high condensation temperature refrigerant by a condenser; and, therefore, the power required for the compressor was reduced. The intermediate heat exchanger was provided with two functions of water preheating and refrigerant vapor-liquid separating. The two functions conventionally had been carried out by separate units, but this time, they were put together into a vertical shell and tube multifunction intermediate heat exchanger. When a heating surface was too large and a water heating quantity was excessive, the system function was deteriorated. Therefore, the level height of the refrigerant inside the shell was adjusted by the sealed quantity of the refrigerant, making the heating surface properly adjustable. With this improved machine, the performance coefficient for hot water supply was improved from 3.44 to 3.72. 14 refs., 16 figs., 13 tabs.

23777 (DOE/AL–94598-1) **Revitalize the US silicon/ferrosilicon industry through energy-efficient technology. Part 1, Final report.** Larson, H.R.; Welborn, J.H. South Carolina Research Authority, North Charleston, SC (United States). Feb 1995. 174p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-93AL94598. Order Number DE95010689. Source: OSTI; NTIS; GPO Dep.

It is concluded that silicon metal and ferrosilicon can be very effectively produced in a DC submerged arc furnace. Specific energy consumption factors measured were favorable to the technology. Significant energy savings over conventional AC practice are likely. Hollow electrode feeding of the furnace does not appear feasible. Electrode consumption was 0.144 lbs/lb so silicon while making metal, much of which occurred above the burden pile. Silicon loss to fume averaged 19.5% of the silicon charge. In this furnace, 50% FeSi was more difficult to produce than silicon metal, and the furnace could not be run with full burden; it was operated successfully about 3/4 full. In the silicon metal portion, the furnace was operated in a fully submerged mode for several 3-day test campaigns. The industry must seriously consider the identified benefits of DC plasma arc technology for retrofit or new added silicon capacity.

23778 (DOE/CE/15452–T1) **Magnetic thin films formed in a glow discharge. Final report.** O'Keefe, T.J.; James, W.J. Missouri Univ., Rolla, MO (United States). 28 Oct 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15452. Order Number DE95015460. Source: OSTI; NTIS; GPO Dep.

Since this project is a continuation of a cooperative effort between UMR and General Motor Research Laboratories (GMR), it seemed fitting to provide some background information which was instrumental in the evolution of this program. A family of filled epoxies that can be cast-to-size into sheet metal stamping dies has been developed by GMR. Advantages of this material over commercial plastic tooling materials are a fast curing rate, high strength, and negligible volume shrinkage after curing. Superior Tooling And Molding Plastic (STAMP) tooling dies are considerably cheaper and faster to make than steel tooling dies; therefore, they are currently used for prototype applications throughout General Motors. With improvement of wear resistance, STAMP dies can be used for limited production applications involving 10,000 or 20,000 parts. GMR proposed to provide a thin ($< 25\ \mu m$) wear surface for the cast-to-size STAMP die to extend its wear performance. The objective of the University of Missouri-Rolla (UMR) research effort is to technically evaluate methodologies to coat STAMP material to appreciably improve wear resistance. This does not necessarily mean that various types of coatings will be developed and evaluated. Rather, the primary responsibility is to characterize the nature of the STAMP material and design engineered films which will lead to an optimized system. An example of this was the finding that a thin polymer layer existed on the surface of an as-cast STAMP die necessitating removal if satisfactory adherence and toughness were to be attained. The next important finding involved the influence of particle size on wear. The theme of the research approach was maintained throughout the course of the project, with improvements being made as the causes of failure were determined and appropriate corrections or improvements were made.

23779 (DOE/CE/23810–60) **Evaluation of HFC-245ca for commercial use in low pressure chillers. Task 1 report: Preliminary estimates of chiller performance.** Keuper, E.F. (Trane Co., LaCrosse, WI (United States)); Hamm, F.B.; Glamm, P.R. Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). 30 Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE95014710. Source: OSTI; NTIS; GPO Dep.

HFC-245ca has been identified as a potential replacement for both CFC-11 and HCFC-123 in centrifugal chillers based on estimates of its thermodynamic properties, even though serious concerns exist about its flammability characteristics. The overall objective of this project is to assess the commercial viability of HFC-245ca in centrifugal chillers. This first report focuses on preliminary estimates of chiller performance only, while the next report will include laboratory performance data. The chiller performance estimates are based on early correlations of thermodynamic properties and predictions of compressor efficiency, with variations in heat transfer ignored until experimental data are obtained. Conclusions from this study include the following: The theoretical efficiency of HFC-245ca in optimized three stage chiller designs is very close to that for CFC-11 and HCFC-123 chillers. HFC-245ca is not attractive as a service retrofit in CFC-11 and HCFC-123 chillers because significant compressor modifications or dramatic lowering of condenser water temperatures would be required. Hurdles which must be overcome to apply HFC-245ca in centrifugal chillers include the flammability behavior, evaluation of toxicity, unknown heat transfer characteristics, uncertain thermodynamic properties, high refrigerant cost and construction of HFC-245ca manufacturing plants. Although the flammability of HFC-245ca can probably be reduced or eliminated by blending HFC-245ca with various inert compounds, addition of these compounds will lower the chiller performance. The chiller performance will be degraded due to less attractive thermodynamic properties and lower heat transfer performance if the blend fractionates. The experimental phase of the project will improve the accuracy of our performance estimates, and the commercial viability assessment will also include the impact of flammability, toxicity, product cost and product availability.

23780 (DOE/CE/40839–T3) **Kraft black liquor delivery systems. Final report.** Empie, J.; Lien, J. Institute of Paper Science and Technology, Atlanta, GA (United States). Feb 1995. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC02-88CE40839. Order Number DE95015552. Source: OSTI; NTIS; GPO Dep.

An improved spray nozzle for black liquor injection into kraft recovery boilers has been sought which is expected to result in obtaining a controlled, well-defined droplet size distribution. An environmentally sound experimental spray facility capable of delivering black liquor at normal firing temperatures has been operated at the Institute of Paper Science and Technology to help achieve that goal. Previous work showed that black liquor sprays have a characteristic size distribution which is determined by the fluid mechanical forces breaking up the spray sheet issuing from the nozzle. Recent work has centered on applying vibratory assist as an independently-controlled force on the sheet breakup process in an attempt to change the drop size distribution. Results are presented which feature vibratory assist applied in the axial direction.

23781 (DOE/EH–231-056/1294) **Disposal requirements for PCB waste.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Dec 1994. 4p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015487. Source: OSTI; NTIS; GPO Dep.

Polychlorinated biphenyls (PCBs) are a class of organic chemicals that had become widely used in industrial applications due to their practical physical and chemical properties. Historical uses of PCBs include dielectric fluids (used in utility transformers, capacitors, etc.), hydraulic fluids, and other applications requiring stable, fire-retardant materials. Due to findings that PCBs may cause adverse health effects and due to their persistence and accumulation in the environment, the Toxic Substances Control Act (TSCA), enacted on october 11, 1976, banned the manufacture of PCBs after 1978 [Section 6(e)]. The first PCB regulations, promulgated at 40 CFR Part 761, were finalized on February 17, 1978. These PCB regulations include requirements specifying disposal methods and marking (labeling) procedures, and controlling PCB use. To assist the Department of Energy (DOE) in its efforts to comply with the TSCA statute and implementing regulations, the Office of Environmental Guidance has prepared the document "Guidance on the Management of Polychlorinated Biphenyls (PCBs)." That document explains the requirements specified in the statute and regulations for managing PCBs including PCB use, storage, transport, and disposal. PCB materials that are no longer in use and have been declared a waste must be disposed of according to the requirements found at 40 CFR 761.60. These requirements establish disposal options for a multitude of PCB materials including soil and debris, liquid PCBs, sludges and slurries, containers, transformers, capacitors, hydraulic machines, and other electrical equipment. This Information Brief supplements the PCB guidance document by responding to common questions concerning disposal requirements for PCBs. It is one of a series of Information Briefs pertinent to PCB management issues.

23782 (DOE/EH–231-057/1294) **The PCB mark.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Dec 1994. 2p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015488. Source: OSTI; NTIS; GPO Dep.

Polychlorinated biphenyls (PCBs) are a class of organic chemicals that had become widely used in industrial applications due to their practical physical and chemical properties. Historical uses of PCBs include dielectric fluids (used in utility transformers, capacitors, etc.), hydraulic fluids, and other applications requiring stable, fire-retardant materials. Due to findings that PCBs may cause adverse health effects and due to their persistence and accumulation in the environment. The Toxic Substances Control Act (TSCA), enacted on October 11, 1976, banned the manufacture of PCBs after 1978 [Section 6(e)]. The first PCB regulations, promulgated at 40 CFR Part 761, were finalized on February 17, 1978. These PCB regulations include requirements specifying disposal methods and marking (labeling) procedures, and controlling PCB use. To assist the Department of Energy (DOE) in its efforts to comply with the TSCA statute and implementing regulations, the Office of Environmental Guidance has prepared the document "Guidance on the Management of Polychlorinated Biphenyls (PCBs)." That document explains the requirements specified in the statute and regulations for managing PCBs including PCB use, storage, transport, and disposal. The requirements outlined at 40 CFR 761.40 through 761.45 specify marking requirements for most PCB items (i.e., any PCB Article, PCB Container, PCB Article Container, or PCB Equipment that contains PCBs). Most PCB items require PCB marks, which are defined as a descriptive name, instructions, cautions, or other information applied to PCB Items or other objects subject to these regulations. The marking regulations include requirements for PCB marks on PCB Items, storage areas, and temporary storage areas. This Information Brief supplements the PCB guidance document by responding to common questions concerning marking requirements for PCBs. It is one of a series of Information Briefs pertinent to PCB management issues.

23783 (DOE/EH–231-058/1294) **PCB recordkeeping and reporting.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Dec 1994. 2p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015489. Source: OSTI; NTIS; GPO Dep.

Polychlorinated biphenyls (PCBs) are a class of organic chemicals that had become widely used in industrial applications due to their practical physical and chemical properties. Historical uses of PCBs include dielectric fluids (used in utility transformers, capacitors, etc.), hydraulic fluids, and other applications requiring stable, fire-retardant materials. Due to findings that PCBs may cause adverse health effects and due to their persistence and accumulation in the environment, the Toxic Substances Control Act (TSCA), enacted on October 11, 1976, banned the manufacture of PCBs after 1978 [Section 6(e)]. The first PCB regulations, promulgated at 40 CFR Part 761, were finalized on February 17, 1978. These PCB regulations include requirements specifying disposal methods and marking (labeling) procedures, and controlling PCB use. To assist the Department of Energy (DOE) in its efforts to comply with the TSCA statute and implementing regulations, the Office of Environmental Guidance has prepared the document "Guidance on the Management of Polychlorinated Biphenyls (PCBs)." That document explains the requirements specified in the statute and regulations for managing PCBs including PCB use, storage, transport, and disposal. All generators, disposers, and storers of PCB waste must comply with the recordkeeping and reporting requirements found at 40 CFR 761.180. The regulations include directions for writing and maintaining annual records and annual document logs and for preparing annual reports, exception reports, manifest discrepancy reports, and unmanifested waste reports. This Information Brief supplements the PCB guidance document by responding to common questions concerning recordkeeping and reporting requirements for PCBs. It is one of a series of Information Briefs pertinent to PCB management issues.

23784 (DOE/EH–231-060/1294) **PCB storage requirements.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Dec 1994. 4p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015490. Source: OSTI; NTIS; GPO Dep.

Polychlorinated biphenyls (PCBs) are a class of organic chemicals that had become widely used in industrial applications due to their practical physical and chemical properties. Historical uses of PCBs include dielectric fluids (used in utility transformers, capacitors, etc.), hydraulic fluids, and other applications requiring stable, fire-retardant materials. Due to findings that PCBs may cause adverse health effects and due to their persistence and accumulation in the environment, the Toxic Substances Control Act (TSCA), enacted on october 11, 1976, banned the manufacture of PCBs after 1978 [Section 6(e)]. The first PCB regulations, promulgated at 40 CFR Part 761, were finalized on February 17, 1978. These PCB regulations include requirements specifying disposal methods and marking (labeling) procedures, and controlling PCB use. To assist the Department of Energy (DOE) in its efforts to comply with the TSCA statute and implementing regulations, the Office of Environmental Guidance has prepared the document "Guidance on the Management of Polychlorinated Biphenyls (PCBs)." That document explains the requirements specified in the statute and regulations for managing PCBs, including PCB use, storage, transport, and disposal. The requirements specified at 40 CFR Part 761.65 require most PCB wastes to be stored in a facility that meets the

specifications of that section. Additionally, the regulations include rules concerning time limits for PCBs and PCB items in storage, rules concerning leaking electrical equipment, and rules concerning types of containers used to store PCBs and PCB items. This Information Brief supplements the PCB guidance document by responding to common questions concerning storage requirements for PCBs. It is one of a series of Information Briefs pertinent to PCB management issues.

23785 (DOE/ID/12624–3) **Collection and conversion of silicon furnace waste gas into higher value products: Phase 3, 6 MW pilot plant dc closed furnace technology. Final report.** Dosaj, V.D. Dow Corning Corp., Midland, MI (United States). Jan 1995. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-87ID12624. Order Number DE95015551. Source: OSTI; NTIS; GPO Dep.

The construction and operation of a 6 MW, closed dc furnace for smelting silicon was the primary focus of Phase 3. A 6 MW, dc closed furnace pilot plant was built in East Selkirk, Manitoba, Canada. The furnace is equipped with world's most modern automatic control system used to control and monitor the process variables and operational data. This control system is suitable for commercial applications and could be used with either closed or open dc furnaces for smelting silicon or ferrosilicon. The construction was started in September 1990, and the facility was operational within 18 months. Following successful commissioning of the pilot plant in June 1992, twelve smelting test campaigns were conducted through November 1994.

23786 (DOE/NE/37969–6) **University of Michigan – 1994-5 performance review of D&D activities. Annual report, June 1, 1994–May 31, 1995.** Wehe, D.K. Michigan Univ., Ann Arbor, MI (United States). 24 Feb 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86NE37969. Order Number DE95015194. Source: OSTI; NTIS; INIS; GPO Dep.

In accordance with work proposed to the ORNL D & D Program, UM navigation group has conducted research in two areas: (1) Theoretical and experimental work for the improvement of dead-reckoning accuracy in mobile robots and (2) a comprehensive literature survey on positioning methods for mobile robots. The radiation imaging group has conducted research in: (1) assessing the existing requirements for gamma ray imagers, (2) hot testing of existing gamma ray imagers, and (3) design and testing of a prototype rotating aperture camera for improved signal/noise ratios and sensitivity.

23787 (ETDE-BR–0001) **Use of electric energy in aviculture related activities.** Pogi, Rita de Cassia. UNESP, Botucatu, SP (Brazil). Faculdade de Ciencias Agronomicas. Jun 1991. 116p. (In Portugese). Order Number DE95789945. Source: OSTI; NTIS (US Sales Only).

In the present research work, the use of electric energy was studied in two activities connected to aviculture, ration factory and hatchery, located in the surroundings of Tiete, in the State of Sao Paulo. The data obtained by the factory refer to the monthly kilos of ration produced between 1986 and 1988; for the hatchery the period studied was 1987-1989 and the monthly data of production refer to one-day chicks. Based on these data it was possible to analyse the behaviour of the two activities as regard as the use of electric energy, through the examining of the electric powers, consumption and production unit, figured average time of electric installations use, kWh cost, functional dependency between the load factor and consumption. Through these evaluations one concludes that in the ration factory the relation (Wh) consumption per kilo varied from 10,30 to 11,05, in the hatchery the relation (Wh) consumption per chick showed a variation from 50,32 to 77,27 and the confronting of the energy use shows that in the hatchery it was more efficient, being connect up to 68,49% of the monthly hours available while in the ration factory this value falls down to 39,59%. (author). 34 refs, 23 figs, 34 tabs

23788 (ETDE-BR–0003) **The use of electric energy in central-pivot systems in the irrigated areas of the Guaira region - Sao Paulo, Brazil.** Cagnon, Jose Angelo. UNESP, Botucatu, SP (Brazil). Faculdade de Ciencias Agronomicas. Dec 1989. 130p. (In Portugese). Order Number DE95789947. Source: OSTI; NTIS (US Sales Only).

In this work the energetic aspects of the operation of irrigation equipment of central-pivot in the region of Guaira - SP were studied. For this purpose were picked up data of 71 irrigation systems, with different capacities of power, grouped according the transformers used: 75, 112,5, 150 and 225 kVa. Important aspects of the evaluation of the electric parameters (consumption, demand and load factor) were analysed, involving climatic parameters, tariff legislation and irrigated area. Regarding the consumption and demand of electric power, were obtained the mean values for the period of March 1987 to February 1989. Tables and graphs containing the results were built, and were used to evaluate the relationship between the mentioned parameters. It was studied the rain distribution along the period and its influence on the consumption and demand values. (author). 33 refs, 27 figs, 26 tabs

23789 (ETDE-BR–0013) **Analysis of energy consumption and the viability to increase the energy use efficiency for thermal applications in the major industrial sectors through the balancing of thermal and electric energy.** Fernandes Filho, Guilherme E. Filippo. UNESP, Guaratingueta, SP (Brazil). Faculdade de Engenharia. 1988. 318p. (In Portugese). Order Number DE95789957. Source: OSTI; NTIS (US Sales Only).

The objective of this work is to propose the increase of electro technologies and co-generation use in the industrial process. Electro technologies must be understood as electro heat, and co-generation as the use liter residual heat of fuels in the generation of electric energy or more efficient introduction of fuels in processes. The more important energetics and forms of consume for thermic proposes in several industrial sectors after researching about 250 industries are identified. The energetic diagnostics of at least one industry of each sector and typical examples of national industry in order to determined the consumption performance at equipment level is presented. Technological alternatives supported in electro technologies and co-generation in order to increase energetic performance of equipment and processes are shown. In case of application of these alternatives by the industry, the consumption of electric energy will increase. In order to avoid overload in the electric system, this paper proposes solutions supported by Magneto-Hydrodynamic (MHD). 89 refs, 112 figs, 130 tabs

23790 (ETDE-BR–0020) **Electric power consumption in the processing of corn used to feed chickens.** Dantas, Antonio Augusto Aguilar. UNESP, Botucatu, SP (Brazil). Faculdade de Ciencias Agronomicas. Dec 1989. 116p. (In Portugese). Order Number DE95789964. Source: OSTI; NTIS (US Sales Only).

In the present research the corn was processed by small hammer mill with different sieves. The specific electric parameters were recorded. The resulting ground corn were used in rations for broilers which had their performance estimated. The data on the processing of corn was studied to relate with chicks development during the twenty eight days of initial growth period. The results show that: the 5 cv engine consumed less energy than the 7.5 cv to process 1 kilo of corn; the weight in the seven initial days of breeding was greater in the treatment which used ground corn processed in the smaller sieves; the food conversion in the seven initial days was greater in function of the sieves with smaller screens; the different rations with processed corn in the four sieves did not interfere in the chicks consumption; there was a big difference in the energy V Ah to process the corn in the 0.8 mm sieve in comparison to the others; the necessary increase of apparent energy (R) for the chicks development for all rations and according to periods (d), followed the expression 1 n (R) = -2,76 + 1.39 1 n (d); the apparent energy increase (R) is smaller in the initial period of chicks development increases in the subsequent periods and tends to stabilize after the day twenty first. 48 refs, 52 tabs, 18 figs

23791 (ETDE-BR–0021) **The use of electric power in coffee processing and corn drying to produce animal rations.** Rodriguez, Eduardo Mendoza. UNESP, Botucatu, SP (Brazil). Faculdade de Ciencias Agronomicas. Nov 1990. 90p. (In Portugese). Order Number DE95789965. Source: OSTI; NTIS (US Sales Only).

The purpose of this work is to study the way in which the electric energy is used in two agroindustrial activities by means of the analysis of electric parameters and data from the processing of

agricultural products collected from 1986 to 1988. The activities studied were the coffee processing of agricultural and the corn drying for feed production. The conclusions are: the seasonal aspects of the coffee production and its commercialization have a semestral behaviour in their processing and consumption of energy; the corn drying associated with the feed production have their activities and consumption of electric energy distributed in periods of four months; the load factor of the coffee processing plant ranged from 0.09 to 0.29 according to the relation of the kilos of coffee processed per kWh, which fluctuated from 9.04 to 36.86; the combination of corn drying and feed production, both occurring at the same place and knowing its seasonal characteristics, enables the rational use of electric energy, keeping its consumption constant; the load factor of the plant ranged from 0.19 to 0.36 with an average value of 0.27. This implies that these activities used the electric energy available more efficiently when comparing to the coffee processing; the average price of the kWh for the coffee processing was higher than the corn drying and feed production in such that the increment in kWh of the coffee processing ranged from 25 to 41% with an average value of 34.3% which increased the costs; the total demand charged in both activities is the sum of both demands, supposing they are coincident in time, which raises the electric energy costs. 28 refs, 31 tabs, 9 figs

23792 (ETDE-BR–0026) **Electric energy consumption in soybean and sorghum milling used in chickens rations.** Mendonca, Maria Denise. UNESP, Botucatu, SP (Brazil). Faculdade de Ciencias Agronomicas. Nov 1990. 120p. (In Portugese). Order Number DE95789970. Source: OSTI; NTIS (US Sales Only).

This research aims the evaluation of the performance of milling machines, considering the electric energy consumption to obtain rations of different granulometry and nutritive quality analysis of this rations in relation to chicken growth. 50 refs, 60 tabs, 17 figs.

23793 (ETDE-DE–163) **Climate-compatible energy supply in Baden-Wuerttemberg. Energy conservation and CO_2 reduction on the traffic sector - vehicle technology.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 22. Fiedler, R.G. (Forschungsinstitut fuer Kraftfahrwesen und Fahrzeugmotoren Stuttgart (FKFS) (Germany)); Helfer, M.; Essers, U. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany). Apr 1994. 84p. (In German). Order Number DE95790270. Source: OSTI; NTIS (US Sales Only).

This brochure is one of the progress reports of the "Academy of Technology Assessment in Baden-Wuerttemberg". It contains an expert's opinion which discusses and assesses the technical potentials of energy conservation and CO_2 reduction in motor cars and engines in consideration of the number of vehicles currently running in Baden-Wuerttemberg. The evaluation of relevant literature and the processing of the information obtained follow the structure of the expert's opinion: Characterisation of the technology - Technical potential - Effects. (orig.)

23794 (KCP–613-5587) **Using STEP to integrate design features with manufacturing features.** Brooks, S.L. (Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div.); Kirk, W.J. III; Simons, W.R. Jr.; Brown, C.W.; Greenway, R.B. Jr. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Apr 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. (CONF-9509140–1: 15. ASME international computer in engineering conference, Boston, MA (United States), 17-21 Sep 1995). Order Number DE95010188. Source: OSTI; NTIS; GPO Dep.

There are several parametric or variational feature-based solid modeling design tools that aid the user in productively creating a product design. However, most of these systems do not address mapping from the design feature to the manufacturing feature. We present a representation for manufacturing features that integrate with design features using the ISO 10303 STEP product definition standard. We extend the STEP AP203 entities with feature definitions in a way similar to AP224, the working draft of STEP Features. The manufacturing features presented here provide a means to link design changes to manufacturing feature and/or process changes. Currently, most systems depend on humans to detect and propagate design and process changes to manufacturing features and plans. Toward solving this problem, we are working on a manufacturing feature representation that can detect a design or process change and correct some, or at a minimum, flag the manufacturing engineer where the change affects manufacturing operations. We define manufacturing features as a collection of faces and edges. It is important that these faces and edges can be uniquely identified in the design feature representation. The STEP entity Shape-Aspect is used to permanently name the face or edge. Our features are built from expressions that reference the design feature's faces and edges that can be reevaluated to propagate a design change. In this paper we present this new approach for representing manufacturing features and discuss its current and planned implementation.

23795 (ORNL/TM–12905) **Evaluation of density separation and other treatment methods for plastic media blasting (PMB) waste.** Spence, R.D.; Morgan, I.L.; Trotter, D.R. Oak Ridge National Lab., TN (United States). [1995]. 46p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95011629. Source: OSTI; NTIS; GPO Dep.

The United States Air Force has developed plastic media blasting (PMB) to replace solvent paint stripping of its aircraft. This paint blasting operation generates a waste stream of mainly pulverized plastic, but the stream also contains enough paint pigments to make the PMB waste RCRA hazardous. A Phase I study identified density separation as the preferred treatment alternative to land disposal of the entire PMB waste stream in a hazardous landfill. This study found density separation to be a less attractive alternative to self-encapsulation, solidification/stabilization (S/S), and low-temperature ashing. Self-encapsulation resulted in a volume decrease but only moderate improvement in Toxicity Characteristic Leaching Procedure (TCLP) performance Solidification/Stabilization (S/S) into cementiaous waste for resulted in excellent TCLP performances, but volume increases. Low-temperature ashing resulted in dramatic volume decreases, but off-gas control is required to contain all the RCRA metals. The resulting ash must be stabilized (e.g., S/S) to meet TCLP limits.

23796 (PNL–10546) **Ammonia and ammonium hydroxide sensors for ammonia/water absorption machines: Literature review and data compilation.** Anheier, N.C. Jr.; McDonald, C.E.; Cuta, J.M.; Cuta, F.M.; Olsen, K.B. Pacific Northwest Lab., Richland, WA (United States). May 1995. 63p. Sponsored by USDOE, Washington, DC (United States);Gas Research Inst., Chicago, IL (United States). DOE Contract AC06-76RL01830. Order Number DE95011871. Source: OSTI; NTIS; GPO Dep.

This report describes an evaluation of various sensing techniques for determining the ammonia concentration in the working fluid of ammonia/water absorption cycle systems. The purpose of this work was to determine if any existing sensor technology or instrumentation could provide an accurate, reliable, and cost-effective continuous measure of ammonia concentration in water. The resulting information will be used for design optimization and cycle control in an ammonia-absorption heat pump. PNL researchers evaluated each sensing technology against a set of general requirements characterizing the potential operating conditions within the absorption cycle. The criteria included the physical constraints for in situ operation, sensor characteristics, and sensor application. PNL performed an extensive literature search, which uncovered several promising sensing technologies that might be applicable to this problem. Sixty-two references were investigated, and 33 commercial vendors were identified as having ammonia sensors. The technologies for ammonia sensing are acoustic wave, refractive index, electrode, thermal, ion-selective field-effect transistor (ISFET), electrical conductivity, pH/colormetric, and optical absorption. Based on information acquired in the literature search, PNL recommends that follow-on activities focus on ISFET devices and a fiber optic evanescent sensor with a colormetric indicator. The ISFET and fiber optic evanescent sensor are inherently microminiature and capable of in situ measurements. Further, both techniques have been demonstrated selective to the ammonium ion (NH_4^+). The primary issue remaining is how to make the sensors sufficiently corrosion-resistant to be useful in practice.

23797 (PNL-SA-25944) **Waste reduction using carbon dioxide: A solvent substitute for precision cleaning applications.** Phelphs, M.R. (and others); Hogan, M.O.; Snowden-Swan, L.J. Pacific Northwest Lab., Richland, WA (United States). May 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9505241--1: 1995 precision cleaning conference, Rosemont, IL (United States), 15-17 May 1995). Order Number DE95014629. Source: OSTI; NTIS; GPO Dep.

The U.S. Department of Energy's (DOE) Industrial Waste Program (IWP) has been sponsoring the research, development, and commercialization of supercritical fluid cleaning technology for replacement of traditional solvent cleaning processes. Los Alamos National Laboratory and Pacific Northwest Laboratory have been working through this collaborative effort to test the efficacy of carbon dioxide (CO_2) cleaning. Tests were performed on a variety of substrates at various solvent conditions for a large number of common contaminants to characterize cleaning performance. Cleaning efficiencies with respect to system dynamics were also studied. Results of these tests show that supercritical and near-critical carbon dioxide is not only an effective solvent for precision cleaning applications of parts such as gyroscopes, bearing assemblies, and machine tools but is also feasible for bulk cleaning operations for a variety of industrial needs. It has been tested and shown to be effective for a range of substrates including laser optics components, computer disk drives, and cloth rags. Metals, including stainless steel, beryllium, gold, silver, copper and others; ceramics; and elastomeric seals such as Teflon, silicone, and epoxy potting compounds are highly compatible with SuperCritical CO_2 ($SCCO_2$). Many contaminants, including silicones, Krytox, hydrocarbons, esters, fluorocarbons, gyroscope damping and fill fluids, and machining oils and lubricating oils, will dissolve in $SCCO_2$. In general, nonpolar, hydrophobic contaminants such as oils dissolve well, while hydrophilic contaminants such as inorganic salts do not. The parts and contaminants mentioned here are not the only applications for SCCO, cleaning, as the full range of possibilities is still being defined by developers and users of the technology. The many advantages of $SCCO_2$ indicate that it is a technology that should carry industrial cleaning operations into the future.

23798 (UCRL-JC-119975) **Plasma arc heated secondary combustion chamber.** Haun, R. (Retech, Inc. (United States)); Paulson, B.; Schlienger, M.; Goerz, D.; Kerns, J.; Vernazza, J. Lawrence Livermore National Lab., CA (United States). Feb 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950216--149: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95014991. Source: OSTI; NTIS; GPO Dep.

This paper describes a secondary combustion chamber (SCC) for hazardous waste treatment systems that uses a plasma arc torch as the heat source. Developed under a cooperative research and development agreement (CRADA) between Retech, Inc. and Lawrence Livermore National Laboratory (LLNL), the unit is intended primarily to handle the off-gas from a Plasma Arc Centrifugal Treatment (PACT) system. ft is designed to heat the effluent gas which may contain volatile organic compounds, and maintain the gas temperature above 1000 C for two seconds or more. The benefits of using a plasma arc gas heater are described in comparison to a conventional fossil fuel heated SCC. Thermal design considerations are discussed. Analysis and experimental results are presented to show the effectiveness in destroying hazardous compounds and reducing the total volume of gaseous emissions.

23799 (UCRL-JC-120745) **A lightweight high performance dual-axis gimbal for space applications.** Pines, D.J.; Hakala, D.B.; Malueg, R. Lawrence Livermore National Lab., CA (United States). 5 May 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950472--8: SPIE international symposium on aerospace/defense sensing and dual-use photonics, Orlando, FL (United States), 17-21 Apr 1995). Order Number DE95014395. Source: OSTI; NTIS; GPO Dep.

This paper describes the design, development and performance of a lightweight precision gimbal with dual-axis slew capability to be used in a closed-loop optical tracking system at Lawrence Livermore National Laboratory-LLNL. The motivation for the development of this gimbal originates from the need to acquire and accurately localize warm objects (T~500 K) in a cluttered background. The design of the gimbal is centered around meeting the following performance requirements: pointing accuracy with control $< 35\ \mu rad\text{-}(1\text{-}\omega)$; slew capability > 0.2 rad/sec; mechanical weight < 5 kg. These performance requirements are derived by attempting to track a single target from multiple satellites in low Earth orbit using a mid-wave infrared camera. Key components in the gimbal hardware that are essential to meeting the performance objectives include a nickel plated beryllium mirro, an accurate lightweight capacitive pickoff device for angular measurement about the elevation axis, a 16-bit coarse/fine resolver for angular measurement about the azimuth axis, a toroidally wound motor with low hysteresis for providing torque about the azimuth axis, and the selection of beryllium parts to insure high stiffness to weight ratios and more efficient thermal conductivity. Each of these elements are discussed in detail to illustrate the design trades performed to meet the tracking and slewing requirements demanded. Preliminary experimental results are also given for various commanded tracking maneuvers.

23800 (WHC-SD-WM-TRP-237) **Laboratory testing of geomembrane for waste containment EPA Method 9090, March 1995. Final report.** Whitlock, R.W. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); TRI/Environmental, Inc., Austin, TX (United States). 15 May 1995. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012589. Source: OSTI; NTIS; GPO Dep.

This report describes the work performed by TRI/Environmental, Inc. (TRI) to determine the chemical compatibility of one geomembrane and one seamed geomembrane with four synthetically generated leachates. The objective was to determine the resistance of the geomembrane to changes caused by exposure to the leachates. Changes in physical and mechanical properties were measured after exposure to the leachates at 23 C and 50 C for 30, 60, 90 and 120 days. Exposures were performed in accordance with the exposure regimen specified in US Environmental Protection Agency (EPA) Method 9090A. Methods, results and discussion are provided. Test results are also provided in the Tables of Results which accompany this report.

23801 (Y/ME-94-08) **Kearney and Trecker Milwaukee Matic 600.** Seat, J.E.; Rogers, K.S. Oak Ridge Y-12 Plant, TN (United States). 21 Oct 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE95009054. Source: OSTI; NTIS; GPO Dep.

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A computer model of a Kearney and Tracker (K and T) Milwaukee Matic 600 (MM600) with a Gemini controller for use under the Deneb Robotics, Inc. simulation environment has been constructed. The simulation uses the K and T controller and standard MM600 machine geometry. Both the machine geometry and the controller are provided. The machine has been constructed using K and T's standard machine dimensions and setup. The controller simulation addresses the most typically used NC codes, but may not be setup for extremely specialized functions. The machine geometry has been reduced to simulate only those components and surfaces which could possibly interfere or collide with other machine components or the workpiece envelope. The level of detail has been reduced to a functional level to enhance computational performance during simulation. The model may be directly used in the Virtual-NC environment for a complete machining simulator, or the model with kinematics may be used in IGRIP. The geometry is suitable for translation into standard file formats for importation into other systems.

3206 Municipalities and Community Systems

Refer also to citation(s) 23725, 23761, 23772, 23776, 24637

23802 (CRIE-W-93033) **Stabilization of transferred type A.C. arc plasma by adding pulse to current zero point.** Iwata, M. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Yasui, S.; Shibuya, M. Central Research Inst. of Electric

Power Industry, Tokyo (Japan). Aug 1994. 19p. (In Japanese). Order Number DE95790558. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

The stabilization of transferred type plasma was examined for the purpose of an A.C. plasma application in waste disposal. Being a method to generate plasma between a torch electrode and a heating object, the transferred type plasma was provided with a high heating efficiency; however, it was likely to be unstable because the plasma length is long. The plasma was able to be stabilized by generating a 200A, 50Hz transferred type A.C. plasma in the atmosphere and by superimposing a pulse current at 10 to 20A with the rising/falling time of 2μs and the pulse width of 400μs. The reason was that the rising ratio dv/dt of interelectrode voltage after current zero point was able to be increased greatly by superimposing a pulse current immediately before A.C. current zero point and that current starting voltage and reignition voltage were able to be decreased through dielectric breakdown between the electrodes before an interelectrode insulation was fully recovered. As an interelectrode distance is lengthened, a high supply voltage was required for the stabilization; however, the stabilization of plasma was made possible even under a low supply voltage by decreasing reignition voltage through the superimposition of a pulse current. 9 refs., 9 figs., 1 tab.

23803 (DOE/CE/26515–T1) **Steamtown District Heating and Cooling Project, Scranton, Pennsylvania. Final report.** Joseph Technology Corp., Inc., Woodcliff Lake, NJ (United States). Apr 1990. 89p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-85CE26515. Order Number DE95009801. Source: OSTI; NTIS; GPO Dep.

This report summarizes the activities of a study intended to examine the feasibility of a district heating and cooling alternative for the Steamtown National Historic Site in Scranton, PA. The objective of the study was to investigate the import of steam from the existing district heating system in Scranton which is operated by the Community Central Energy Corporation and through the use of modern technology provide hot and chilled water to Steamtown for its internal heating and cooling requirements. Such a project would benefit Steamtown by introducing a clean technology, eliminating on-site fuel use, avoiding first costs for central heating and cooling plants and reducing operation and maintenance expenditures. For operators of the existing district heating system, this project represents an opportunity to expand their customer base and demonstrate new technologies. The study was conducted by Joseph Technology Corporation, Inc. and performed for the Community Central Energy Corporation through a grant by the US Department of Energy. Steamtown was represented by the National Park Service, the developers of the site.

23804 (DOE/CH/10093–322-Rev.2) **Using landfill gas for energy: Projects that pay.** National Renewable Energy Lab., Golden, CO (United States). Feb 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94006897. Source: OSTI; NTIS; GPO Dep.

Pending Environmental Protection Agency regulations will require 500 to 700 landfills to control gas emissions resulting from decomposing garbage. Conversion of landfill gas to energy not only meets regulations, but also creates energy and revenue for local governments.

23805 (NREL/TP–430-7974) **Case studies in residual use and energy conservation at wastewater treatment plants.** Stewart, D. (Science Applications International Corp., Los Altos, CA (United States)). National Renewable Energy Lab., Golden, CO (United States); Science Applications International Corp., Los Altos, CA (United States). Jun 1995. 72p. Sponsored by USDOE, Washington, DC (United States);Environmental Protection Agency, Washington, DC (United States). DOE Contract AC36-83CH10093. (EPA–832-R-95-003). Order Number DE95009216. Source: OSTI; NTIS; GPO Dep.

The US Environmental Protection Agency (EPA) and the National Renewable Energy Laboratory (NREL) for the US Department of Energy (DOE) funded a study to document energy conservation activities and their effects on operation costs, regulatory compliance, and process optimization at several wastewater treatment plants (WWTPS). The purpose of this report is to review the efforts of wastewater treatment Facilities that use residuals as fuels. Case histories are presented for facilities that have taken measures to reduce energy consumption during wastewater treatment. Most of the WWTPs discussed in this report have retrofitted existing facilities to achieve energy conservation. The case studies of energy conservation measures found no effects on the facilities' ability to comply with NPDES permits. Indeed, energy conservation activities enhance environmental compliance in several ways.

23806 (NREL/TP–430-7976) **Environmental legislation and the regulation of waste management in Sweden.** National Renewable Energy Lab., Golden, CO (United States); CSI Resource Systems, Inc., Duxbury, MA (United States). May 1995. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009219. Source: OSTI; NTIS; GPO Dep.

This study examines the regulatory aspects of waste management in Sweden, with a particular emphasis on regulating organic compounds produced by waste-to-energy facilities. Since the early 1960s, waste-to-energy has played a significant role in managing waste in Sweden. In 1993, more than 50% of the municipal solid waste available for treatment or disposal following source separation efforts was processed in one of the 21 waste-to-energy facilities operating in Sweden. This report examines Sweden's regulatory environment, its history of setting emission limits on waste management facilities, and the current status of regulations.

23807 (PNL–10592) **Hanford 300 Area steam transition preliminary utility options study.** Olson, N.J.; Weakley, S.A.; Berman, M.J. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014185. Source: OSTI; NTIS; GPO Dep.

The cost of steam in the Hanford 300 Area is approaching $60 per million Btu; the cost in industry is $\approx$ $10 per million Btu. The cost of steam in the 300 Area is expected to continue to increase because of the age of the central steam system, load decreases, safety requirements, and environmental regulations. The intent of this report is to evaluate options that would more cost-effectively met the future heating needs of the buildings in the 300 Area. In general, the options fall into two categories: central systems and distributed systems. A representative option from each category was analyzed using the life-cycle cost analysis (LCCA) techniques mandated by the federal government. The central plant option chosen for evaluation was the existing central steam plant modified to allow continued operation. The distributed option chosen was a dedicated heating system for each building.

23808 (UCRL-ID–120296) **Laboratory studies of a hydrothermal pretreatment process for municipal solid waste.** Wallman, H. Lawrence Livermore National Lab., CA (United States). 6 Apr 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015132. Source: OSTI; NTIS; GPO Dep.

The objective of this work was to establish operating conditions for a hydrothermal pre-processing scheme for municipal solid wastes that produce a good slurry product for conversion in a Texaco gasifier. Work was carried out with model components such as wood, paper, and paper/plastic mixtures.

33 ADVANCED PROPULSION SYSTEMS

3301 Internal Combustion Engines

Refer also to citation(s) 23714, 23882

23809 (ANL/ES/CP–85485) **Devices to improve the performance of a conventional two-stroke spark ignition engine.** Poola, R.B. (Argonne National Lab., IL (United States)); Nagalingam, B.; Gopalakrishnan, K.V. Argonne National Lab., IL (United States). [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9504174–1: American Society of Mechanical Engineers (ASME)

1995 Spring technical conference, Marietta, OH (United States), 23-26 Apr 1995). Order Number DE95013492. Source: OSTI; NTIS; GPO Dep.

This paper presents research efforts made in three different phases with the objective of improving the fuel economy of and reducing exhaust emissions from conventional, carbureted, two-stroke spark ignition (SI) engines, which are widely employed in two-wheel transportation in India. A review concerning the existing two-stroke engine technology for this application is included. In the first phase, a new scavenging system was developed and tested to reduce the loss of fresh charge through the exhaust port. In die second phase, the following measures were carried out to improve the combustion process: (1) using an in-cylinder catalyst, such as copper, chromium, and nickel, in the form of coating; (2) providing moderate thermal insulation in the combustion chamber, either by depositing thin ceramic material or by metal inserts; (3) developing a high-energy ignition system; and (4) employing high-octane fuel, such as methanol, ethanol, eucalyptus oil, and orange oil, as a blending agent with gasoline. Based on the effectiveness of the above measures, an optimized design was developed in the final phase to achieve improved performance. Test results indicate that with an optimized two-stroke SI engine, the maximum percentage improvement in brake thermal efficiency is about 31%, together with a reduction of 3400 ppm in hydrocarbons (HC) and 3% by volume of carbon monoxide (CO) emissions over the normal engine (at 3 kW, 3000 rpm). Higher cylinder peak pressures (3-5 bar), lower ignition delay (2-4°CA)° and shorter combustion duration (4-10 °CA) are obtained. The knock-limited power output is also enhanced by 12.7% at a high compression ratio (CR) of 9:1. The proposed modifications in the optimized design are simple, low-cost and easy to adopt for both production and existing engines.

23810 (SAND–95-8562C) **Autoignition of hydrogen under direct-injection compression-ignition engine conditions.** Naber, J.D.; Siebers, D.L. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9504161–1: Central States/Western States Institute and American Flame Research committee meeting, San Antonio, TX (United States), 23-26 Apr 1995). Order Number DE95010760. Source: OSTI; NTIS; GPO Dep.

The autoignition and combustion of hydrogen were studied in a constant-volume combustion vessel under simulated late-cycle, direct-injection (DI) diesel engine conditions. A strong Arrhenius dependence of ignition delay on temperature was observed; however, the ignition delay dependence on the other variables examined was small. The results show that a reasonable ignition delay (< 2 ms) can be achieved at ambient gas temperatures in excess of 1100 K for oxygen concentrations as low as 5%. In addition, the results show that DI hydrogen combustion rates are insensitive to these lower levels of oxygen. The insensitivity of ignition delay and combustion rate to reduced oxygen concentration is significant because it offers the potential for a dramatic reduction in emissions of nitric oxides from a compression-ignited DI hydrogen engine through use of large quantities of exhaust-gas-recirculation.

3302 External Combustion Engines

Refer also to citation(s) 23714

3303 Electric-Powered Systems

Refer also to citation(s) 23744

23811 (ANL/CMT/CP–85327) **Development and performance characteristics of bipolar lithium/iron disulfide battery.** Vissers, D.R.; Kaun, T.D.; Prakash, J.; Turner, R.L.; Hash, M.C.; Henriksen, G.L. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950298–1: International workshop on advanced batteries, Osaka (Japan), 22-24 Feb 1995). Order Number DE95012469. Source: OSTI; NTIS; GPO Dep.

The purpose of this paper is to review the projected performance and safety characteristics of the bipolar lithium/iron disulfide battery as it relates to a propulsion device for electric vehicles (EVs). Lithium/iron disulfide cells with a molten-salt electrolyte are well suited to the development of a bipolar battery. Long strings of series-connected cells are practical since these cells always fail in a short-circuit condition, and a technique has been developed to equalize the cells whose capacity may have gotten out of balance after many cycles. To maintain the electrolyte molten, the battery is normally operated at 425°C. The $LiFeS_2$ cell exhibits the high performance and long life needed for the electric vehicle application. The cell uses a molten-salt electrolyte whose composition is 34 mol% LiCl 32.5 mol% LiBr-33.5. mol% KBr (m.p. 322°C, and a densely loaded FeS_2 electrode that is only operated on the upper voltage plateau (UP). The Li-Al alloy is used as the negative electrode in the cell. The alloy is normally operated in the $\alpha+\beta$ region of the phase diagram and covers a compositional range of 9 to 47 atom % lithium. This two-phase alloy is within 300 mV of the pure lithium metal potential, but remains solid at cell operating temperatures (400-450°C).

23812 (ANL/ESD–27) **User's guide to EAGLES Version 1.1: An electric- and gasoline-vehicle fuel-efficiency software package.** Marr, W.W. Argonne National Lab., IL (United States). Jan 1995. 136p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95014763. Source: OSTI; NTIS; GPO Dep.

EAGLES is an interactive microcomputer software package for the analysis of fuel efficiency in electric-vehicle (EV) applications or the estimation of fuel economy for a gasoline vehicle. The principal objective of the EV analysis is to enable the prediction of EV performance on the basis of laboratory test data for batteries. The EV model included in the software package provides a second-by-second simulation of battery voltage and current for any specified vehicle velocity/time or power/time profile. The capability of the battery is modeled by an algorithm that relates the battery voltage to the withdrawn (or charged) current, taking into account the effect of battery depth-of-discharge. Alternatively, the software package can be used to determine the size of the battery needed to satisfy given vehicle mission requirements. For gasoline vehicles, a generic fuel-economy model based on data from EPA Test Car List 1991 is included in the software package. For both types of vehicles, effects of heating/cooling loads on vehicle performance, including range penalty for EVs, can be studied. Also available is an option to estimate the time needed by a specified vehicle to reach a certain speed with the application of a constant power and an option to compute the fraction of time and/or distance in a driving cycle at speeds exceeding a specified value. Certain parameters can be changed interactively prior to a run.

23813 (DOE/CE/50389–1) **Direct-hydrogen-fueled proton-exchange-membrane (PEM) fuel cell system for transportation applications. Quarterly technical progress report Number 1, July 1–September 30, 1994.** Oei, G. Ford Motor Co., Dearborn, MI (United States). 4 Nov 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-94CE50389. Order Number DE95009675. Source: OSTI; NTIS; GPO Dep.

This is the first Technical Progress Report for DOE Contract No. DE-AC02-94CE50389 awarded to Ford Motor Company on July 1, 1994. The overall objective of this contract is to advance the Proton-Exchange-Membrane (PEM) fuel cell technology for automotive applications. Specifically, the objectives resulting from this contract are to: (1) develop and demonstrate on a laboratory propulsion system within 2-1/2 years a fully functional PEM Fuel Cell Power System (including fuel cell peripherals, peak power augmentation and controls), this propulsion system will achieve, or will be shown to have the growth potential to achieve, the weights, volumes, and production costs which are competitive with those same attributes of equivalently performing internal combustion engine propulsion systems; (2) select and demonstrate a baseline onboard hydrogen storage method with acceptable weight, volume, cost, and safety features and analyze future alternatives; (3) analyze the hydrogen infrastructure components to ensure that hydrogen can be safely supplied to vehicles at geographically widespread convenient sites and at prices which are less than current gasoline prices per vehicle-mile; (4) identify any future R and D needs for a fully integrated vehicle and for achieving the system cost and performance goals.

23814 (DOE/ID/13074–T16) **Kansas State University: DOE/KEURP Site Operator Program. Year 4, fourth quarterly report, April 1, 1995–June 30, 1995.** Kansas State Univ., Manhattan, KS (United States). [1995]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-91ID13074. Order Number DE95015960. Source: OSTI; NTIS; GPO Dep.

Kansas State University, in support of a DOE and Kansas Electric Utilities Research Program subject contract, continues to test, evaluate, demonstrate, and develop electric vehicle and infrastructure technology. K-State is operating two Soleq EVcort vehicles. During this reporting period both vehicles were brought back to full operational status after warranty service was completed by Soleq. Vehicle failures occurred due to three unrelated battery cable failures in addition to the replacement of one battery. Both vehicles are being operated on a routine basis. K-State, along with York Technical College, has established a relationship with Troy Design and Manufacturing (TDM) Redford, Michigan. K-State has ordered no less than four Ford Ranger electric trucks from TDM. K-State is involved in the steering committee that is monitoring and refining information to direct the design and testing of these new technology vehicles. TDM should become the first automotive manufacturer certified by one of the Big Three under their Quality Vehicle Manufacturer program. Kansas State University and the Kansas Electric Utility Research Program look forward to working with TDM on their new EV program.

23815 (SAND–95-1125C) **SERAPHIM: A propulsion technology for fast trains.** Kelly, B.; Turman, B.; Marder, B.; Rohwein, G.; Aeschliman, D.; Cowan, B. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950857–1: Society of Automotive Engineers future transportation technology conference and exposition, Costa Mesa, CA (United States), 7-10 Aug 1995). Order Number DE95013017. Source: OSTI; NTIS; GPO Dep.

The Segmented Rail Phased Induction Motor (SERAPHIM) is a compact, pulsed linear induction motor (LIM) offering a unique capability for very high speed train propulsion. It uses technology developed for the Sandia coilgun, an electromagnetic launcher designed to accelerate projectiles to several kilometers per second. Both aluminum cylinders and plates were accelerated to a kilometer per second (Mach 3) by passing through a sequence of coils which were energized at the appropriate time. Although this technology was developed for ultra-high velocity, it can be readily adapted to train propulsion for which, at sea level, the power required to overcome air resistance limits the operational speed to a more modest 300 mph. Here, the geometry is reversed. The coils are on the vehicle and the "projectiles" are fixed along the roadbed. SERAPHIM operates not by embedding flux in a conductor, but by excluding it. In this propulsion scheme, pairs of closely spaced coils on the vehicle straddle a segmented aluminum reaction rail. A high frequency current is switched on as a coil pair crosses an edge and remains off as they overtake the next segment. This induces surface currents which repel the coil. In essence, the pulsed coils push off segment edges because at the high frequency of operation, the flux has insufficient time to penetrate. In contrast to conventional LIMs, the performance actually improves with velocity, even for a minimal motor consisting of a single coil pair reacting with a single plate. This paper will present results of proof-of-principle tests, electromagnetic computer simulations, and systems analysis. It is concluded that this new linear induction motor can be implemented using existing technology and is a promising alternative propulsion method for very high speed rail transportation.

23816 (UCRL-JC–120308) **A refuelable zinc/air battery for fleet electric vehicle propulsion.** Cooper, J.F.; Fleming, D.; Hargrove, D.; Koopman, R.; Peterman, K. Lawrence Livermore National Lab., CA (United States). 20 Apr 1995. 11p. Sponsored by USDOE, Washington, DC (United States);Department of Transportation, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950857–2: Society of Automotive Engineers future transportation technology conference and exposition, Costa Mesa, CA (United States), 7-10 Aug 1995). Order Number DE95013263. Source: OSTI; NTIS; GPO Dep.

We report the development and on-vehicle testing of an engineering prototype zinc/air battery. The battery is refueled by periodic exchange of spent electrolyte for zinc particles entrained in fresh electrolyte. The technology is intended to provide a capability for nearly continuous vehicle operation, using the fleet s home base for 10 minute refuelings and zinc recycling instead of commercial infrastructure. In the battery, the zinc fuel particles are stored in hoppers, from which they are gravity fed into individual cells and completely consumed during discharge. A six-celled (7V) engineering prototype battery was combined with a 6 V lead/acid battery to form a parallel hybrid unit, which was tested in series with the 216 V battery of an electric shuttle bus over a 75 mile circuit. The battery has an energy density of 140 Wh/kg and a mass density of 1.5 kg/L. Cost, energy efficiency, and alternative hybrid configurations are discussed.

3306 Vehicle Design Factors

Refer also to citation(s) 23814, 23822, 23823, 24012

23817 (CONF-9410309–5) **Advanced computational research in materials processing for design and manufacturing.** Zacharia, T. (Oak Ridge National Lab., TN (United States). Metals and Ceramics). Oak Ridge National Lab., TN (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Contractor's coordination meeting; Dearborn, MI (United States); 24-27 Oct 1994. Order Number DE95013355. Source: OSTI; NTIS; GPO Dep.

The computational requirements for design and manufacture of automotive components have seen dramatic increases for producing automobiles with three times the mileage. Automotive component design systems are becoming increasingly reliant on structural analysis requiring both overall larger analysis and more complex analyses, more three-dimensional analyses, larger model sizes, and routine consideration of transient and non-linear effects. Such analyses must be performed rapidly to minimize delays in the design and development process, which drives the need for parallel computing. This paper briefly describes advanced computational research in superplastic forming and automotive crash worthiness.

3307 Emission Control

23818 (UCRL-JC–120646) **Radical oxidation automotive de-NO_x.** Chang, B.; Garcia, M. Lawrence Livermore National Lab., CA (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950875–2: International symposium on plasma chemistry, Minneapolis, MN (United States), 21-25 Aug 1995). Order Number DE95013451. Source: OSTI; NTIS; GPO Dep.

The authors describe an experiment to remove NO_x from air-like gas flows by optimizing its oxidation to nitric acid. Their aim is to demonstrate an efficient de-NO_x process that can replace the catalytic converter of today's automobiles and recover greater engine performance. NO is oxidized to HNO_3 by injecting O_3 from an auxiliary air discharge unit, and the acid is scrubbed by a granular NaOH filter, the final product being $NaNO_3$. In theory this scheme requires less engine power than the enthalpy loss through the catalytic converter, and permits engine operation with oxygen-rich fuel mixtures at high compression ratios for peak thermodynamic efficiency. Experiments utilize a glass tube flow reactor with a 20 liter/minute flow mixed from the separate injections of compressed ozonized air and an admixture of 200 ppm of NO in nitrogen from a small pressurized bottle, for net proportions of 89% N_2, 11% O_2, 120 ppm NO. Ozone concentration is selected by adjusting the frequency of the repetitive-pulsed coaxial-barrier air discharge cell. For O_3:NO ratios greater than unity a chain of reactions successively produce NO_2, NO_3, and N_2O_5 which then combines with ambient H_2O to form HNO_3. The overall efficiency is dominated by the electrical efficiency of the ozonizer, at present about 30 eV/O_3 within the discharge.

3308 Alternative Fuels

Refer also to citation(s) 23128, 23414, 23415, 23432

23819 (CONF-9504160–5) **Hydrogen fuel dispensing station for transportation vehicles.** Singh, S.P.N. (Oak Ridge National Lab., TN (United States). Chemical Technology Div.); Richmond, A.A. Oak Ridge National Lab., TN (United States). [1995]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1995 DOE/NREL hydrogen program review; Coral Gables, FL (United States); 18-21 Apr 1995. Order Number DE95014271. Source: OSTI; NTIS; GPO Dep.

A technical and economic assessment is being conducted of a hydrogen fuel dispensing station to develop an understanding of the infrastructure requirements for supplying hydrogen fuel for mobile applications. The study includes a process design of a conceptual small-scale, stand-alone, grassroots fuel dispensing facility (similar to the present-day gasoline stations) producing hydrogen by steam reforming of natural gas. Other hydrogen production processes (such as partial oxidation of hydrocarbons and water electrolysis) were reviewed to determine their suitability for manufacturing the hydrogen. The study includes an assessment of the environmental and other regulatory permitting requirements likely to be imposed on a hydrogen fuel dispensing station for transportation vehicles. The assessment concludes that a dispensing station designed to produce 0.75 million standard cubic feet of fuel grade (99.99%+ purity) hydrogen will meet the fuel needs of 300 light-duty vehicles per day. Preliminary economics place the total capital investment (in 1994 US dollars) for the dispensing station at $4.5 million and the annual operating costs at around $1 million. A discounted cash-flow analysis indicates that the fuel hydrogen product price (excluding taxes) to range between $1.37 to $2.31 per pound of hydrogen, depending upon the natural gas price, the plant financing scenario, and the rate of return on equity capital. A report on the assessment is due in June 1995. This paper presents a summary of the current status of the assessment.

23820 (NREL/TP–425-6550) **Evaluation of aftermarket CNG conversion kits in light-duty vehicle applications. Final report.** Blazek, C.F. (Institute of Gas Technology, Chicago, IL (United States)); Rowley, P.F.; Grimes, J.W. National Renewable Energy Lab., Golden, CO (United States). Jul 1995. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94006893. Source: OSTI; NTIS; GPO Dep.

The Institute of Gas Technology (IGT) was contracted by the National Renewable Energy Laboratory (NREL) to evaluate three compressed natural gas (CNG) conversion systems using a 1993 Chevrolet Lumina baseline vehicle. A fourth conversion system was added to the test matrix through funding support from Brooklyn Union. The objective of this project was to measure the Federal Test Procedure (FTP) emissions and fuel economy of the different conversion systems, and to compare the performance to gasoline-fueled operation and each other. Different natural gas compositions were selected to represent the 10th percentile, mean, and 90th percentile compositions distributed in the Continental United States. Testing with these different compositions demonstrated the systems' ability to accommodate the spectrum of gas found in the United States. Each compressed natural gas conversion system was installed and adjusted according to the manufacturer's instructions. In addition to the FTP testing, an evaluation of the comparative installation times and derivability tests (based on AGA and CRC guidelines) were conducted on each system.

23821 (NREL/TP–425-7518) **Atmospheric process evaluation of mobile source emissions.** National Renewable Energy Lab., Golden, CO (United States); California Univ., Riverside, CA (United States). Center for Environmental Research and Technology. Jul 1995. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009224. Source: OSTI; NTIS; GPO Dep.

During the past two decades there has been a considerable effort in the US to develop and introduce an alternative to the use of gasoline and conventional diesel fuel for transportation. The primary motives for this effort have been twofold: energy security and improvement in air quality, most notably ozone, or smog. The anticipated improvement in air quality is associated with a decrease in the atmospheric reactivity, and sometimes a decrease in the mass emission rate, of the organic gas and NO_x emissions from alternative fuels when compared to conventional transportation fuels. Quantification of these air quality impacts is a prerequisite to decisions on adopting alternative fuels. The purpose of this report is to present a critical review of the procedures and data base used to assess the impact on ambient air quality of mobile source emissions from alternative and conventional transportation fuels and to make recommendations as to how this process can be improved. Alternative transportation fuels are defined as methanol, ethanol, CNG, LPG, and reformulated gasoline. Most of the discussion centers on light-duty AFVs operating on these fuels. Other advanced transportation technologies and fuels such as hydrogen, electric vehicles, and fuel cells, will not be discussed. However, the issues raised herein can also be applied to these technologies and other classes of vehicles, such as heavy-duty diesels (HDDs). An evaluation of the overall impact of AFVs on society requires consideration of a number of complex issues. It involves the development of new vehicle technology associated with engines, fuel systems, and emission control technology; the implementation of the necessary fuel infrastructure; and an appropriate understanding of the economic, health, safety, and environmental impacts associated with the use of these fuels. This report addresses the steps necessary to properly evaluate the impact of AFVs on ozone air quality.

23822 (NREL/TP–425-7618) **Hardware assembly and prototype testing for the development of a dedicated liquefied propane gas ultra low emission vehicle.** National Renewable Energy Lab., Golden, CO (United States); IMPCO Technologies, Seattle, WA (United States). Jul 1995. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009250. Source: OSTI; NTIS; GPO Dep.

On February 3, 1994, IMPCO Technologies, Inc. started the development of a dedicated LPG Ultra Low Emissions Vehicle (ULEV) under contract to the Midwest Research Institute National Renewable Energy Laboratory Division (NREL). The objective was to develop a dedicated propane vehicle that would meet or exceed the California ULEV emissions standards. The project is broken into four phases to be performed over a two year period. The four phases of the project include: (Phase 1) system design, (Phase 2) prototype hardware assembly and testing, (Phase 3) full-scale systems testing and integration, (Phase 4) vehicle demonstration. This report describes the approach taken for the development of the vehicle and the work performed through the completion of Phase II dynamometer test results. Work was started on Phase 2 (Hardware Assembly and Prototype Testing) in May 1994 prior to completion of Phase 1 to ensure that long lead items would be available in a timely fashion for the Phase 2 work. In addition, the construction and testing of the interim electronic control module (ECM), which was used to test components, was begun prior to the formal start of Phase 2. This was done so that the shortened revised schedule for the project (24 months) could be met. In this report, a brief summary of the activities of each combined Phase 1 and 2 tasks will be presented, as well as project management activities. A technical review of the system is also given, along with test results and analysis. During the course of Phase 2 activities, IMPCO staff also had the opportunity to conduct cold start performance tests of the injectors. The additional test data was most positive and will be briefly summarized in this report.

23823 (NREL/TP–425-7629) **Inspection of compressed natural gas cylinders on school buses.** National Renewable Energy Lab., Golden, CO (United States); Acurex Environmental Corp., Mountain View, CA (United States). Jul 1995. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE95009231. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) is sponsoring compressed natural gas (CNF)-powered school bus demonstrations in various locations around the country. Early in 1994, two non-DOE-sponsored CNG pickup trucks equipped with composite-reinforced-aluminum fuel cylinders experienced cylinder ruptures during refueling. As reported by the Gas Research Institute (GRI): ...analysis of the cylinder ruptures on the pickup trucks revealed that they were due to acid-induced stress corrosion cracking (SCC) of the overwrap. The overwrap that GRI refers to is a resin-impregnated fiber that is wrapped around the outside of the gas

cylinder for added strength. Because ensuring the safety of the CNG vehicles it sponsors is of paramount concern to DOE, the Department, through the National Renewable Energy Laboratory (NREL), conducted inspections of DOE-sponsored vehicles nationwide. The work had three objectives: inspection, documentation, and education. First, inspectors visited sites where CNG-powered school buses sponsored by DOE are based, and inspected the CNG cylinders for damage. Second, information learned during the inspections was collected for DOE. Third, the inspections found that the education and awareness of site personnel, in terms of cylinder damage detection, needed to be increased.

23824 (UCRL-JC–120152) **A smooth transition to hydrogen transportation fuel.** Berry, G.D.; Smith, J.R.; Schock, R.N. Lawrence Livermore National Lab., CA (United States). 14 Apr 1995. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9504160–4: 1995 DOE/NREL hydrogen program review, Coral Gables, FL (United States), 18-21 Apr 1995). Order Number DE95014391. Source: OSTI; NTIS; GPO Dep.

The goal of this work is to examine viable near-term infrastructure options for a transition to hydrogen fueled vehicles and to suggest profitable directions for technology development. The authors have focused in particular on the contrasting options of decentralized production using the existing energy distribution network, and centralized production of hydrogen with a large-scale infrastructure. Delivered costs have been estimated using best available industry cost and deliberately conservative economic assumptions. The sensitivities of these costs have then been examined for three small-scale scenarios: (1) electrolysis at the home for one car, and production at the small station scale (300 cars/day), (2) conventional alkaline electrolysis and (3) steam reforming of natural gas. All scenarios assume fueling a 300 mile range vehicle with 3.75 kg. They conclude that a transition appears plausible, using existing energy distribution systems, with home electrolysis providing fuel costing 7.5 to 10.5¢/mile, station electrolysis 4.7 to 7.1¢/mile, and steam reforming 3.7 to 4.7¢/mile. The average car today costs about 6¢/mile to fuel. Furthermore, analysis of liquid hydrogen delivered locally by truck from central processing plants can also be competitive at costs as low as 4¢/mile. These delivered costs are equal to $30 to $70 per GJ, LHV. Preliminary analysis indicates that electricity transmission costs favor this method of distributing energy, until very large (10 GW) hydrogen pipelines are installed. This indicates that significant hydrogen pipeline distribution will be established only when significant markets have developed.

35 ARMS CONTROL

Refer also to citation(s) 24423, 24424

3501 Policy, Negotiations, and Legislation

23825 (ANL/DIS/CP–86453) **Legal aspects of national implementation of the Chemical Weapons Convention national authority provisions. Workshop I: The National Authority.** Tanzman, E.A. (Argonne National Lab., IL (United States)); Kellman, B. Argonne National Lab., IL (United States). 9 May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505207–3: Regional seminar on the national implementation of the chemical weapons convention, Yamoussoukro (South Africa), 9 May 1995). Order Number DE95011827. Source: OSTI; NTIS; GPO Dep.

This seminar is an excellent opportunity for all attendees to learn from each other about how the Chemical Weapons Convention (CWC) can become a foundation of arms control in Africa and around the world. The author discusses legal aspects of implementing the CWC's national authority provisions. These implementing measures are universal, applying not only to the few States Parties that will declare and destroy chemical weapons, but also to the many States Parties that have never had a chemical weapons programme. This new need for national measures to implement multilateral arms control agreements has generated unease due to a perception that implementation may be burdensome and at odds with national law. In 1993, concerns arose that the complexity of integrating the treaty with national law would cause each nation to effectuate the Convention without regard to what other nations were doing, thereby engendering significant disparities in implementation steps among States Parties. As a result, the author prepared the Manual for National Implementation of the Chemical Weapons Convention late last year and presented it to each national delegation at the December 1993 meeting of the Preparatory Commission in The Hague. Here the author discusses progress among several States in actually developing implementing measures for the Convention's national authority requirements. CWC legislation from Australia, Germany, Norway, South Africa, and Sweden were available at this writing in English through the PTS. Of course, it is important to note that this brief survey necessarily omitted examination of the existing "background" of other, related domestic laws that these signatories might also have adopted that affect CWC implementation. The author hopes that his brief review will give delegations a flavor of the choices that exist for national implementation of the CWC.

23826 (DOE/EIS–0218D-Vol.2-App.F) **Draft environmental impact statement on a proposed nuclear weapons nonproliferation policy concerning foreign research reactor spent nuclear fuel: Volume 2, Appendix F, Description and impacts of storage technology alternatives.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1995. 326p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012343. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix presents a description and evaluation of currently available spent nuclear fuel storage technologies, and their applicability to foreign research reactor spent nuclear fuel. These technologies represent the range of alternatives dW would be available to implement the proposed action. Some of these technologies are currently in use at US Department of Energy (DOE) facilities. Several dry storage cask and/or building designs have been licensed by the US Nuclear Regulatory Commission (NRC) and are operational with commercial nuclear power plant spent fuel at several locations. This appendix also discusses potential storage sites and impacts of foreign research reactor spent nuclear fuel storage at these locations.

3502 Proliferation

Refer also to citation(s) 23390

23827 (DOE/EA–0971) **Environmental assessment for device assembly facility operations, Nevada Test Site, Nye County, Nevada. Final report.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). May 1995. 39p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014001. Source: OSTI; NTIS; GPO Dep.

The U.S. Department of Energy, Nevada Operations Office (DOE/NV), has prepared an environmental assessment (EA), (DOE/EA-0971), to evaluate the impacts of consolidating all nuclear explosive operations at the newly constructed Device Assembly Facility (DAF) in Area 6 of the Nevada Test Site. These operations generally include assembly, disassembly or modification, staging, transportation, testing, maintenance, repair, retrofit, and surveillance. Such operations have previously been conducted at the Nevada Test Site in older facilities located in Area 27. The DAF will provide enhanced capabilities in a state-of-the-art facility for the safe, secure, and efficient handling of high explosives in combination with special nuclear materials (plutonium and highly enriched uranium). Based on the information and analyses in the EA, DOE has determined that the proposed action would not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). Therefore, an environmental impact statement is not required, and DOE is issuing this finding of no significant impact.

23828 (GAO/RCED–94-119) **Nuclear nonproliferation: Concerns with US delays in accepting foregin research reactors' spent fuel.** USDOE, Washington, DC (United States). 25 Mar

1994. 28p. Sponsored by General Accounting Office, Washington, DC (United States). Order Number DE95015118. Source: OSTI; NTIS; INIS.

One key US nonproliferation goal is to discourage use of highly enriched uranium fuel (HEU), which can be used to make nuclear bombs, in civilian nuclear programs worldwide. DOE's Off-Site Fuels Policy for taking back spent HEU from foreign research reactors was allowed to expire due to environmental reasons. This report provides information on the effects of delays in renewing the Off-Site Fuels Policy on US nonproliferation goals and programs (specifically the reduced enrichment program), DOE's efforts to renew the fuels policy, and the price to be charged to the operators of foreign reactors for DOE's activities in taking back spent fuel.

3503 Verification

Refer also to citation(s) 24433, 24434

23829 (BNL–61395) **MACS as a tool for international inspections.** Curtiss, J.A.; Indusi, J.P. Brookhaven National Lab., Upton, NY (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States);Defense Nuclear Agency, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950787–3: 36. annual meeting of the Institute for Nuclear Materials Management, Palm Desert, CA (United States), 9-12 Jul 1995). Order Number DE95013318. Source: OSTI; NTIS; INIS; GPO Dep.

General acceptance of the challenge provision in the Chemical Weapons Convention has the potential for influence in other arms control areas. While most applications of the challenge inspection may be straightforward, there may be instances where access to the site by inspectors may be problematic. The MACS system described in this paper was developed to respond to these situations. Inspection and verification may be difficult when a host is unwilling,for valid reasons, to permit physical access to a site. We proposed a system of remote sensors which may be used to demonstrate compliance with Chemical Weapons Convention (CWC) challenge inspections even ff the inspector is physically excluded from a sensitive site. The system is based upon alternative-means-of-access provisions of the CWC. The Defense Nuclear Agency (DNA) funded design and construction of a system prototype, designated as MACS for Managed Access by Controlled Sensing. Features of the MACS design allow growth of the prototype into a versatile device for international monitoring of production facilities and other sites. MACS consists of instrumentation and communication equipment allowing site personnel to conduct a facility tour and perform acceptable measurements, while physically excluding the inspector from the facility. MACS consists of a base station used by the inspector, and a mobile unit used within the facility and manipulated by the facility staff. The base station and the mobile unit are @ed by a communication system, currently realized as a fiber optic cable. The mobile unit is equipped with television cameras and remote-reading distance-measuring equipment (DME) for use in verifying locations and dimensions. Global Positioning System receivers on the mobile unit provide both precise location and dead reckoning, suitable for tracking the mobile unit's position while within a building when satellite signals are not available.

23830 (UCRL-ID–120947) **Status report on source properties important for discrimination.** Glenn, L.A. Lawrence Livermore National Lab., CA (United States). Mar 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015126. Source: OSTI; NTIS; GPO Dep.

To begin, we need to discuss what is meant by source properties important for discrimination. Here we are concerned primarily with discriminating earthquakes from explosions by seismic means. We do not distinguish between chemical and nuclear explosions because, for concentrated explosions, these will appear identical except for a factor of two or so in the long-period amplitude (which will not be identifiable at a distant seismic station). Ripple-fired chemical explosions may, in theory, be distinguished from concentrated explosions by the spectral modulation that is produced by the former, however we specifically exclude spatio-temporal organization and other geometric effects and concentrate on material properties that have important influence on characteristics of the seismic signal which might allow explosions to be distinguished from earthquakes. The most prominent of these are the corner frequency of the seismic spectrum, the high-frequency roll-off, and the long-period overshoot. Both quasi-analytical[1] methods and finite difference numerical solutions of the hydro-dynamic equations 1-6 were used to explore the effects of the: (1) equation of state of the explosion products; (2) equation of state of the rock media surrounding the explosion; (3) energy and mass density of the explosion source; (4) constitutive properties of the surrounding rock media, including: (a) compressive and tensile strength; (b) porosity; (c) dilatancy; and (d) elastic moduli; and (5) depth of burial (lithostatic overburden). The calculations performed thus far assumed one-dimensional radial symmetry for the most part so that, in addition to geometric details of the source excluded from consideration, depth effects on spall are excluded as well. For our analysis we have chosen models that offer a wide range of parametric behavior and also that have generally given good agreement with experiment.

36 MATERIALS

Refer also to citation(s) 24028

3601 Metals and Alloys

Refer also to citation(s) 23140, 23574, 23593, 23774, 23777, 23778, 24009, 24014, 24029, 24045, 24051, 24056, 24255, 24262, 24299, 24905, 24907

23831 (ANL/ES/CP–84366) **Calcium metal as a scavenger for antimony from aluminum alloys.** Bonsignore, P.V.; Daniels, E.J.; Wu, C.T. Argonne National Lab., IL (United States). 4 Oct 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950201–17: Annual meeting and exhibition of the Minerals, Metals and Materials Society (TMS), Las Vegas, NV (United States), 12-16 Feb 1995). Order Number DE95012290. Source: OSTI; NTIS; GPO Dep.

Previous work has shown that trace amounts of antimony (Sb) can affect the mechanical properties of strontium (Sr) modified aluminum castings. ANL has been investigating technology to remove or neutralize Sb to reduce its negative effect on the physical properties of those alloys. Review of past work on processing and recovery of scrap aluminum inferred that calcium (Ca) is an effective scavenger of Sb, bismuth, lead and cadmium. Following up on that lead, we have found that Ca is, indeed, effective for removing Sb from molten aluminum alloys although its effectiveness can be compromised by a wide range of processing conditions. A minimum ratio of about four to one, by weight, of Ca to Sb appears necessary to insure an effective scavenging of contained Sb.in 356 aluminum alloys.

23832 (ANL/ET/CP–86147) **Mechanically reliable surface oxides for high-temperature corrosion resistance.** Natesan, K.; Veal, B.W.; Grimsditch, M.; Renusch, D.; Paulikas, A.P. Argonne National Lab., IL (United States). May 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505204–2: 9, annual conference on fossil energy materials, Oak Ridge, TN (United States), 16-18 May 1995). Order Number DE95013531. Source: OSTI; NTIS; GPO Dep.

Corrosion is widely recognized as being important, but an understanding of the underlying phenomena involves factors such as the chemistry and physics of early stages of oxidation, chemistry and bonding at the substrate/oxide interface, role of segregants on the strength of that bond, transport processes through scale, mechanisms of residual stress generation and relief, and fracture behavior at the oxide/substrate interface. Because of this complexity a multilaboratory program has been initiated under the auspices of the DOE Center of Excellence for the Synthesis and Processing of Advanced Materials, with strong interactions and cross-leveraging with DOE Fossil Energy and US industry. Objective is to systematically generate the knowledge required to establish a scientific basis for designing and synthesizing improved protective

oxide scales/coatings (slow-growing, adherent, sound) on high-temperature materials without compromising the requisite properties of the bulk materials. The objectives of program work at Argonne are to (1) correlate actual corrosion performance with stresses, voids, segregants, interface roughness, initial stages of oxidation, and microstructures; (2) study such behavior in growing or as-grown films; and (3) define prescriptive design and synthesis routes to mechanically reliable surface oxides. Several techniques, such as Auger electron spectroscopy, X-ray diffraction, X-ray grazing incidence reflectance, grazing-angle X-ray fluorescence, optical fluorescence, and Raman spectroscopy, are used in the studies. Tne project has selected Fe-25 wt.% Cr-20 wt.% Ni and Fe-Cr-Al alloys, which are chromia- and alumina-formers respectively, for the studies. This paper presents some of the results on early stages of oxidation and on surface segregation of elements.

23833 (ANL-HEP-TR–95-32) **Travel to Steel Warehouse Inc., Southbend, Indiana. Trip report, May 4, 1995.** Hill, N.F. (Argonne National Lab., IL (United States). High Energy Physics Div.). Argonne National Lab., IL (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013744. Source: OSTI; NTIS; INIS; GPO Dep.

On May 4, 1995 the author visited a steel plate and coil, cold reduction facility at Steel Warehouse Inc. located in South Bend, Indiana about 150 miles from Argonne. Some very interesting facts were learned about cold reduction of hot rolled steel during this visit. The company selected is only a cold reduction mill and buys steel from a number of steel producers. The author spent a total of about three hours with these people, and this included a tour of their pickling line, the small cold reduction mill which at present is limited to 15.5 in width maximum, and their large cold reduction mill which produces sheet and coil up to 72 in. wide. Some of the things that were learned, that will have an impact on the production of the Atlas steel plates are given here. (1) Hot rolled coils have some inherent, interesting, characteristics that must be taken into consideration when being cold reduced. (2) The monitoring of the coil thickness is only done along the center line of the coil, this has a serious impact on QC of plates cut from this coil for a number of reasons. (3) Hot rolled coils of steel in this particular instance may come from a number of different sources. This could cause problems if magnetic permeability is a serious issue. It was the author's impression that this facility is fairly typical of what one might expect from any similar facility.

23834 (ANL/MSD/CP–83449) **Grain size dependent mechanical properties in nanophase materials.** Siegel, R.W. (Argonne National Lab., IL (United States)); Fougere, G.E. Argonne National Lab., IL (United States). Feb 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38 ; FG02-86ER45229. (CONF-941144–150: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95012400. Source: OSTI; NTIS; GPO Dep.

It has become possible in recent years to synthesize metals and ceramics under well controlled conditions with constituent grain structures on a manometer size scale (below 100 nm). These new materials have mechanical properties that are strongly grain-size dependent and often significantly different than those of their coarser grained counterparts. Nanophase metals tend to become stronger and ceramics are more easily deformed as grain size is reduced. The observed mechanical property changes appear to be related primarily to grain size limitations and the large percentage of atoms in grain boundary environments. A brief overview of our present knowledge about the grain-size dependent mechanical properties of nanophase materials is presented.

23835 (ANL/XFD/CP–83323) **Magnetic Compton scattering studies of the Invar alloy Fe_3Pt.** Yahnke, C.J.; Srajer, G.; Haeffner, D.R.; Mills, D.M.; Assoufid, L. Argonne National Lab., IL (United States). Feb 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9411234–1: Applications of synchrotron radiation techniques to materials science, Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95013385. Source: OSTI; NTIS; GPO Dep.

The magnetic Compton profiles (MCP) for both ordered and disordered Fe_3Pt samples have been measured above and below their Curie temperature. These measurements show that the average moment per atom at room temperature is $2.8\mu_B \pm 0.1\mu_B$ for disordered Fe_3Pt and $1.8\mu_B \pm 0.1\mu_B$ for ordered Fe_3Pt., At temperatures above T_c, we measured a substantial reduction in the moment ($0.6\mu_B \pm 0.1\mu_B$ for disordered Fe_3Pt and $0.6\mu_B \pm 0.1\mu_B$ for ordered Fe_3Pt) and a change in the shape of the MCP. These results indicate a decrease of the d-like moment on the Fe atoms in the disordered phase. The MCP for the ordered phase shows a change in the total moment, yet the momentum distribution is substantially different and cannot be described by this analysis.

23836 (BNL–61673) **A Scanning Auger Microprobe analysis of corrosion products associated with sulfate reducing bacteria.** Sadowski, R.A. (State Univ. of New York, Stony Brook, NY (United States). Dept. of Materials Science and Engineering); Chen, G.; Clayton, C.R.; Kearns, J.R.; Gillow, J.B.; Francis, A.J. Brookhaven National Lab., Upton, NY (United States). Mar 1995. 13p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC02-76CH00016. Contract N0001485K0437. (CONF-950304–15: Corrosion '95: National Association of Corrosion Engineers (NACE) international annual conference and corrosion show, Orlando, FL (United States), 26-31 Mar 1995). Order Number DE95011780. Source: OSTI; NTIS; GPO Dep.

A Scanning Auger Microprobe analysis was performed on the corrosion products of an austenitic AISI type 304 SS after a potentiostatic polarization of one volt for ten minutes in a modified Postgate's C media containing sulfate reducing bacteria. The corrosion products were characterized and mapped in local regions where pitting was observed. A critical evaluation of the applicability of this technique for the examination of microbially influenced corrosion (MIC) is presented.

23837 (CONF-941016–7) **Fracture behavior of Cr_2Nb-based intermetallics.** Cook, J.A. (Univ. of Tennessee, Knoxville, TN (United States). Dept. of Materials Science and Engineering); Liaw, P.K.; Liu, C.T. Oak Ridge National Lab., TN (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Materials week '94; Rosemont, IL (United States); 3-7 Oct 1994. Order Number DE95013223. Source: OSTI; NTIS; GPO Dep.

Microstructural evaluations and mechanical testing of Laves-phase alloys based on Cr_2Nb were examined in order to determine phase relationships with heat treating temperatures up to 1,600 C. At ambient temperatures, single-phase Cr_2Nb alloys are very hard and brittle due to the complicated crystal structure (C-15). The following results were revealed through examination of the Cr-Cr_2Nb two-phase region: (a) with increasing amounts of the soft chromium-rich phase, the compression strength and hardness decrease; (b) the annealing treatments studied provided the best break-up of the brittle Laves-containing eutectic phase in the 94 at.% Cr-6 at.% Nb (CN-7) alloy; (c) annealing for 1 hour at 1,600 C + 4 hours at 1,200 C drastically improved the room temperature strength and compressive ductility over previous annealing treatments. Previous studies have shown that the introduction of a soft chromium phase has promising effects in improving the mechanical properties of brittle Cr_2Nb Laves-phase alloys.

23838 (CONF-941144–159) **Some unusal properties of the fine structure of dislocations in Ni_3Al deformed at high temperature.** Veyssiere, P. (Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France)); Horton, J.A. Oak Ridge National Lab., TN (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1994 fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 28 Nov - 2 dec 1994. Order Number DE95013226. Source: OSTI; NTIS; GPO Dep.

In Ni_3Al polycrystals deformed at 850°C and quenched rapidly, surface defects exhibit two kinds of behaviour. On the one hand, dislocation coupling by antiphase boundary (APB) and complex stacking fault (CSF) is of normal magnitude for this alloy composition. On the other hand, separations are dramatically decreased in both cases. A method to visualize antiphase boundaries using a weakly excited superlattice reflection is introduced.

23839 (CONF-950201–19) **Room and elevated temperature mechanical properties of PM TiAl alloy Ti-47Al-2Cr-2Nb.** Liu, C.T. (Oak Ridge National Lab., TN (United States)); Maziasz, P.J.; Schneibel, J.H.; Sikka, V.K.; Wright, J.; Walker, L.R.; Clemens, D.R.; Nieh, T.G. Oak Ridge National Lab., TN (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; W-7405-ENG-48. From Annual meeting and exhibition of the Minerals, Metals and Materials Society (TMS); Las Vegas, NV (United States); 12-16 Feb 1995. Order Number DE95014993. Source: OSTI; NTIS; GPO Dep.

A TiAl alloy powder with the composition Ti-47Al-2Cr-2Nb (at. %) was prepared by rotary atomization, followed by hot-extrusion and subsequent heat treatments to produce refined lamellar structures and fine duplex structures. The mechanical properties of the TiM alloy were determined at temperatures to 1000C in air, and the microstructures were characterized by TEM, SEM, and electron microprobe analyses. The alloy with the refined lamellar structure showed excellent mechanical properties at both room and elevated temperatures. It exhibited a plastic strain of 1.4% and a yield strength of 971 MPa (140.9 ksi) at room temperature. The yield strength remained approximately constant up to 800C and decreased to 577 MPa (83.7 ksi) at 1000C. The transverse fracture toughness, estimated by three-point bend testing of chevron-notched specimens at room temperature, was 22.4 MPa $\sqrt{m}$. The refined lamellar structure contained long and straight alternating α_2 and γ platelets with an extremely fine interlamellar spacing (0.1 μm) and α_2-to-α_2 spacing (0.22 μm). The mechanical properties of the alloy have been correlated with the unique microstructures developed by hot extrusion.

23840 (CONF-9502109–1) **Time-dependent stress concentration and microcrack nucleation in TiAl.** Yoo, M.H. Oak Ridge National Lab., TN (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States);Alexander von Humboldt-Stiftung, Bonn (Germany). DOE Contract AC05-84OR21400. From International symposium on gamma titanium aluminides (ISGTA-95); Las Vegas, NV (United States); 12 Feb - 16 mar 1995. Order Number DE95014268. Source: OSTI; NTIS; GPO Dep.

Localized stress evolution associated with the interaction of slip or twinning with an interface is treated by means of a superposition of the "internal loading" of a crystalline subsystem by dynamic dislocation pile-up and the stress relaxation by climb of interfacial dislocations. The peak value of a stress concentration factor depends on both the angular function that includes the effect of mode mixity and the ratio of characteristic times for stress relaxation and internal loading. The available experimental data on orientation and strain-rate dependences of interfacial fracture mode in polysynthetically twinned TiAl crystals are discussed in view of the theoretical concepts presented in this paper.

23841 (CONF-950412–22) **Collisional effects of background gases on pulsed laser deposition plasma beams.** Geohegan, D.B. (Oak Ridge National Lab., TN (United States)); Puretzky, A.A. Oak Ridge National Lab., TN (United States). Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Spring meeting of the Materials Research Society (MRS); San Francisco, CA (United States); 17-21 Apr 1995. Order Number DE95013986. Source: OSTI; NTIS; GPO Dep.

The penetration of energetic pulsed ablation plumes through ambient gases is experimentally characterized to investigate a general phenomenon believed to be important to film growth by pulsed laser deposition (PLD). Under typical PLD conditions involving background gases, the ion flux in the ablation plume is observed to split into distinct fast and slow components over a limited range of distances. The fast component is transmitted with near-initial velocities and high kinetic energies, potentially damaging to growing films at these distances. Formation of the second, significantly-slowed component correlates with the bright contact front formation observed in fast ICCD imaging studies. This general effect is explored in detail for the case of yttrium ablation into argon, a single-element target into an inert gas. Time-resolved optical absorption spectroscopy and optical emission spectroscopy are employed to simultaneously view the populations of both excited and ground states of Y and Y^+ for comparison with quantitative intensified-CCD photography of the visible plume luminescence and ion flux measurements made with fast ion probes during this phenomenon. These measurements confirm that, in addition to the bright significantly-slowed front which has been described by shock or drag propagation models, a fast-component of target material is transmitted to extended distances for some ambient pressures with near-initial velocities.

23842 (CONF-950412–23) **Laser-solid interaction and dynamics of the laser-ablated materials.** Chen, K.R.; Leboeuf, J.N.; Geohegan, D.B.; Wood, R.F.; Donato, J.M.; Liu, C.L.; Puretzky, A.A. Oak Ridge National Lab., TN (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States);Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC05-84OR21400. From Spring meeting of the Materials Research Society (MRS); San Francisco, CA (United States); 17-21 Apr 1995. Order Number DE95014199. Source: OSTI; NTIS; INIS; GPO Dep.

Rapid transformations through the liquid and vapor phases induced by laser-solid interactions are described by the authors' thermal model with the Clausius-Clapeyron equation to determine the vaporization temperature under different surface pressure condition. Hydrodynamic behavior of the vapor during and after ablation is described by gas dynamic equations. These two models are coupled. Modeling results show that lower background pressure results lower laser energy density threshold for vaporization. The ablation rate and the amount of materials removed are proportional to the laser energy density above its threshold. The authors also demonstrate a dynamic source effect that accelerates the unsteady expansion of laser-ablated material in the direction perpendicular to the solid. A dynamic partial ionization effect is studied as well. A self-similar theory shows that the maximum expansion velocity is proportional to $c_s\alpha$, where $1 - \alpha$ is the slope of the velocity profile. Numerical hydrodynamic modeling is in good agreement with the theory. With these effects, α is reduced. Therefore, the expansion front velocity is significantly higher than that from conventional models. The results are consistent with experiments. They further study how the plume propagates in high background gas condition. Under appropriate conditions, the plume is slowed down, separates with the background, is backward moving, and hits the solid surface. Then, it splits into two parts when it rebounds from the surface. The results from the modeling will be compared with experimental observations where possible.

23843 (CONF-9504176–1) **Structure and composition of clean and hydrogen covered MoRe surfaces.** Hammer, L. (and others); Meyer, S.; Rath, C. Oak Ridge National Lab., TN (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States);Deutsche Forschungsgemeinschaft, Bonn (Germany). DOE Contract AC05-84OR21400. From Surface science '95 symposium; Kizsteinhorn/Kaprun (Austria); 23-29 Apr 1995. Order Number DE95013992. Source: OSTI; NTIS; GPO Dep.

The clean and hydrogen covered (100) and (110) faces of $Mo_{0.75}Re_{0.23}$ alloy single crystals show 1x1 structures. By means of LEED structure analyses we have determined the interlayer distances as well as the layer concentrations down to the sixth layer. While the clean (110) surface turns out to be nearly bulklike terminated, the clean (100) face is found to exhibit both an extended oscillatory layer relaxation and composition profile. Hydrogen adsorption at low temperatures does not alter the composition profile and removes the small remaining relaxation for the (110) surface. In case of the (100) face a substancial reduction of the relaxation is observed for the outermost layer distances as well, while deeper layer relaxations are preserved indicating a strong coupling off relaxation and composition profiles. Hydrogen is found to adsorb in quasi-threefold coordinated sites for the (110) and bridge sites for the (100) face.

23844 (CONF-9505204–5) **High-temperature corrosion behavior of iron-aluminide alloys and coatings.** Tortorelli, P.F. (Oak Ridge National Lab., TN (United States)); DeVan, J.H.; Pint, B.A.; Wright, I.G.; Saunders, S.R.J. Oak Ridge National Lab., TN (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 9, annual conference on fossil energy materials; Oak Ridge, TN (United States); 16-18 May 1995. Order Number DE95014280. Source: OSTI; NTIS; GPO Dep.

An Fe-28 at.% Al-2% Cr alloy doped with Y_2O_3 showed improved scale adhesion relative to a dispersion-free form of the same composition. However, doping with CeO_2 or La_2O_3 was detrimental to oxidation behavior. A study of weld-overlay iron-aluminide coatings showed that, those with sufficiently high aluminum concentrations had sulfidation resistance in H_2S-H_2-H_2O-Ar at 800 C equivalent to the most resistant bulk iron aluminides. These corrosion-resistant coatings have the potential to be effective barriers in high-temperature sulfidizing environments provided the appropriate combinations of filler metal, process parameters, and substrate are used to produce adequate aluminum concentrations and minimal chromium contents. Exposures in an oxidizing/sulfidizing environment containing varying amounts of HCl at 450 and 550 C showed that Fe_3Al alloys had good corrosion resistance.

23845 (CONF-9506144–7) **Application of damage models in metal forming.** Zhu, Y.Y.; Zacharia, T. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States);Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC05-84OR21400. From 5. international conference on numerical methods in industrial forming processes (NUMIFORM); Ithaca, NY (United States); 18-21 Jun 1995. Order Number DE95013221. Source: OSTI; NTIS; GPO Dep.

The development of damage models in the analysis of metal forming processes, to characterize the formability limits, is an important area of ongoing research. In this paper, two energy-based damage models for the simulation of crack initiation in metal forming processes are presented. The first one is an isotropic damage model with two damage variables. The second one is an anisotropic model with a damage characteristic tensor. The damage models are developed within the general framework of continuum thermodynamics for irreversible processes by identifying a proper set of internal variables together with their associated generalized forces. An approach is proposed to account for microcrack opening and closing. A viscoplastic regularization algorithm is used to take into account the strain rate effect and to improve numerical stability. Both models have been incorporated into the finite element code, LAGAMINE. The models were applied to simulations of upsetting of collar cylinders and nonisothermal hemispherical punch stretching. The results of the analyses were validated by comparing the finite element simulations with experimentally obtained data.

23846 (CONF-9506209–1) **Mechanistic modeling of high-temperature ordered intermetallics.** Yoo, M.H. (Technische Universitaet Hamburg-Harburg (Germany)); Fu, C.L. Oak Ridge National Lab., TN (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States);Alexander von Humboldt-Stiftung, Bonn (Germany). DOE Contract AC05-84OR21400. From 2. Pacific Rim international conference on advanced materials and processing (PRICM-2); Kyongju (Korea, Republic of); 18-22 Jun 1995. Order Number DE95014269. Source: OSTI; NTIS; GPO Dep.

Bulk and defect properties and their relationships with mechanical behavior of transition-metal aluminides and silicides are reviewed on the basis of the recent progress in theoretical modeling studies. For Ti_3Al, the structural energy difference between the $L1_2$ and $D0_{19}$ structures was found to be very small, which suggests the possibility of improving ductility through structural modification by ternary additions. While the driving force for the yield strength anomaly in Ni_3Al is believed to stem from the anisotropies of APB energies and crystal elasticity, that for Ni_3Si and $Ni_3(Si,Ti)$ is not understood. Cleavage strength of Ti-rich TiAl is expected to be relatively low because of the deficiency of crack-tip plasticity.

23847 (CONF-950740–66) **Heavy-Section Steel Irradiation Program on irradiation effects in light-water reactor pressure vessel materials.** Nanstad, R.K. (Oak Ridge National Lab., TN (United States). Metals and Ceramics Div.); Corwin, W.R.; Alexander, D.J.; Haggag, F.M.; Iskander, S.K.; McCabe, D.E.; Sokolov, M.A.; Stoller, R.E. Oak Ridge National Lab., TN (United States). [1995]. 15p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessels and piping conference; Honolulu, HI (United States); 23-27 Jul 1995. Order Number DE95014273. Source: OSTI; NTIS; INIS; GPO Dep.

The safety of commercial light-water nuclear plants is highly dependent on the structural integrity of the reactor pressure vessel (RPV). In the absence of radiation damage to the RPV, fracture of the vessel is difficult to postulate. Exposure to high energy neutrons can result in embrittlement of radiation-sensitive RPV materials. The Heavy-Section Steel Irradiation (HSSI) Program at Oak Ridge National Laboratory, sponsored by the US Nuclear Regulatory Commission (USNRC), is assessing the effects of neutron irradiation on RPV material behavior, especially fracture toughness. The results of these and other studies are used by the USNRC in the evaluation of RPV integrity and regulation of overall nuclear plant safety. In assessing the effects of irradiation, prototypic RPV materials are characterized in the unirradiated condition and exposed to radiation under varying conditions. Mechanical property tests are conducted to provide data which can be used in the development of guidelines for structural integrity evaluations, while metallurgical examinations and mechanistic modeling are performed to improve understanding of the mechanisms responsible for embrittlement. The results of these investigations, in conjunction with results from commercial reactor surveillance programs, are used to develop a methodology for the prediction of radiation effects on RPV materials. This irradiation-induced degradation of the materials can be mitigated by thermal annealing, i.e., heating the RPV to a temperature above that of normal operation. Thus, thermal annealing and evaluation of reirradiation behavior are major tasks of the HSSI Program. This paper describes the HSSI Program activities by summarizing some past and recent results, as well as current and planned studies. 30 refs., 8 figs., 1 tab.

23848 (CONF-950892–7) **Energy-filtered imaging of precipitates in FeCuN alloys.** Rice, P.M. (Oak Ridge National Lab., TN (United States). Metals and Ceramics Div.); Stoller, R.E.; Bentley, J. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From 53. annual meeting of Microscopy Society of America; Kansas City, KS (United States); 13-17 Aug 1995. Order Number DE95013038. Source: OSTI; NTIS; GPO Dep.

The microstructures of a series of model ferritic alloys are being characterized by transmission electron microscopy (TEM) techniques. The alloys have varying concentrations of Cu (0 to 0.9 wt%), N (5 to 120 appm), and other solutes to allow a systematic study of the effects of various elements on embrittlement. The first step in this process is the characterization of the alloys in their as-received state: solution treated at 775 C for 17 h, quenched in a salt bath at 450 C for 180 s, and subsequently air cooled. The imaging portion of this initial study is complete; however, several questions about the chemical content of many of the precipitates remain unanswered. To study the affect of Cu precipitation on the hardening of the alloys, a 0.9 wt% Cu alloy was annealed at 550 C for times up to 15 h. The Cu precipitates that form undergo a phase change from bcc to a faulted fcc (9R) crystal structure when they are about 6 nm in diameter. These fcc precipitates have been well characterized by conventional TEM techniques for these alloys. However, the smaller bcc Cu precipitates.

23849 (CONF-9508134–1) **Phase transformations and microstructure development in low alloy steel welds.** Babu, S.S. (and others); David, S.A.; Vitek, J.M. Oak Ridge National Lab., TN (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International symposium on phase transformations during thermal/mechanical processing of steel; Vancouver (Canada); 20-23 Aug 1995. Order Number DE95014284. Source: OSTI; NTIS; GPO Dep.

Microstructure development in low alloy steel welds depends on various phase transformations that are a function of weld heating and cooling. The phase changes include non-metallic oxide inclusion formation in the liquid state, weld pool solidification, and solid state transformations. In this paper the mechanism of inclusion formation during low alloy steel welding is considered and the model predictions are compared with published results. The effect of inclusions on the austenite to ferrite transformation kinetics is measured and the mechanisms of transformation are discussed. The austenite gain development is related to the driving force for transformation of δ ferrite to austenite.

23850 (CONF-9509118–6) **An integrated model for optimizing weld quality.** Zacharia, T. (Oak Ridge National Lab., TN (United States)); Radhakrishnan, B.; Paul, A.J.; Cheng, C. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Modeling of casting, welding and advanced solidification processes 7; London (United Kingdom); 10-15 Sep 1995. Order Number DE95013220. Source: OSTI; NTIS; GPO Dep.

Welding has evolved in the last few decades from almost an empirical art to an activity embodying the most advanced tools of, various basic and applied sciences. Significant progress has been made in understanding the welding process and welded materials. The improved knowledge base has been useful in automation and process control. In view of the large number of variables involved, creating an adequately large database to understand and control the welding process is expensive and time consuming, if not impractical. A recourse is to simulate welding processes through a set of mathematical equations representing the essential physical processes of welding. Results obtained from the phenomenological models depend crucially on the quality of the physical relations in the models and the trustworthiness of input data. In this paper, recent advances in the mathematical modeling of fundamental phenomena in welds are summarized. State of the art mathematical models, advances in computational techniques, emerging high performance computers, and experimental validation techniques have provided significant insight into the fundamental factors that control the development of the weldment. Current status and scientific issues in heat and fluid flow in welds, heat source metal interaction, and solidification microstructure are assessed. Future research areas of major importance for understanding the fundamental phenomena in weld behavior are identified.

23851 (DOE/ER–45529) **Growth induced magnetic anisotropy in amorphous thin films. Annual progress report year 1, November 4, 1994–October 31, 1995.** Hellman, F. (Univ. of California, San Diego, La Jolla, CA (United States). Dept. of Physics). California Univ., San Diego, La Jolla, CA (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-95ER45529. (CONF-950380–2: Annual meeting of the Division of High Polymer Physics of the American Physical Society, San Jose, CA (United States), 20-24 Mar 1995). Order Number DE95015362. Source: OSTI; NTIS; GPO Dep.

The work in the past year has primarily involved three areas of magnetic thin films: amorphous rare earth-transition metal alloys, epitaxial COPt3 thin films, and exchange coupled antiferromagnetic insulators. In the amorphous alloys, the authors have focused on understanding the cause and the effect of the growth-surface-induced perpendicular magnetic anisotropy. Using the results of previous work, they are able to control this anisotropy quite precisely. This anisotropy is predicted to have dramatic and as-yet unobserved effects on the underlying nature of the magnetism. The work on the epitaxial Co-Pt alloys was originally undertaken as a comparison study to the amorphous alloys. The authors have discovered that these alloys exhibit a remarkable new phenomena; a surface-induced miscibility gap in a material which is believed to be completely miscible in the bulk. This miscibility gap is 100% correlated with the perpendicular anisotropy, although the connection is not yet clear, and is presumably linked to a magnetic energy of mixing which tends to drive a material towards clustering. The problem of exchange coupling in multilayers impacts many of the current research areas in magnetism. NiO/CoO multilayers can be prepared with coherent interfaces. The specific heat shows unambiguously the ordering of the spins in the layers. The results show clearly the transition from a single transition temperature to two distinct transitions with increasing thickness of the individual layers. From this data, the authors are able to determine the interface magnetic exchange coupling constant and the effect on the transition temperature of finite layer thickness.

23852 (DOE/PC/92542–T10) **Robotic weld overlay coatings for erosion control. Quarterly technical progress report, January 1995–March 1995.** Levin, B.F.; Dupont, J.N.; Marder, A.R. Lehigh Univ., Bethlehem, PA (United States). Energy Research Center. 25 Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92PC92542. Order Number DE95015957. Source: OSTI; NTIS; GPO Dep.

Research is presently being conducted to develop a criteria for selecting weld overlay coatings for erosion mitigation in Circulated Fluidized Beds. During the last two quarters tensile tests were performed at 400°C for the Ultimet, Inconel-625, 316L SS, C-22, and Stellite-6 wrought alloys. Also, the erosion tests for these materials at 400°C were completed. The results of mechanical and erosion tests are used to correlate mechanical properties of selected wrought alloys such as tensile toughness, ductility, strain hardening coefficient and yield strength to their erosion resistance at 400°C. Preliminary results of correlations between erosion resistance of wrought alloys at 400°C and their mechanical properties are presented in this progress report.

23853 (ENEA-RT-ERG-FUS–95-06) **Induction heating in in-line strip production process.** Costa, P. (ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione); Santinelli, M. Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy). May 1995. 17p. (In Italian). Order Number DE95789739. Source: OSTI; NTIS (US Sales Only).

ISP (in-line strip production), a continuous process for steel strip production, has recently been set in an italian innovative plant, where ecological impact and power requirements are lighter than usual. This report describes the studies performed by ENEA (Italian Agency for New Technologies, Energy and the Environment), while a prototype reheating facility was arranged by Acciaieria ISP in Cremona (Italy). The authors, after a study of the prototype electromagnetic field, calculate the heating rate, with the thermal network method. Then they detect, with a 1-D-FEM, the heat diffusion through the strip cross section. Afterward, since the heat distribution depends on the eddy current density one, which is given by the magnetic field distribution, the authors, with a 3-D-FEM, carry out a coupled, electromagnetic and thermal, analysis in time domain. The strip temperature map is established by the balance between skin depth heating and surface cooling: a thermal analysis, performed with a moving 2-D-FEM, take into account the effects of the different heating and cooling situations, originated by the strip moving at a speed of 6m/min through four consecutive reheating facilities. The temperatures of a strip sample heated by the prototype have been monitored, acquired by a computer and related with the simulation results. The little difference between experiment and simulation assessed the qualitative and quantitative validity of this analysis, that has come out to be a tool, useful to evaluate the effects of possible improvements to the ISP process.

23854 (FZKA–5550) **Irradiation programme MANITU: Results of pre-examinations and Charpy tests with unirradiated materials.** Rieth, M.; Dafferner, B.; Ries, H.; Romer, O. Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Inst. fuer Materialforschung; Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Hauptabteilung Versuchstechnik; Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Projekt Kernfusion; Association Euratom-Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Apr 1995. 74p. (In German). Order Number DE95795766. Source: OSTI; NTIS (US Sales Only); INIS.

The irradiation project MANITU was planned in the frame of the European Long-term Fusion Materials Development Programme. The results of MANITU will have a lasting influence on the future actions within the materials development programme. The problem of the irradiation induced embrittlement of possible martensitic alloy candidates is still unsolved. But after the evaluation of sub-size Charpy tests with the unirradiated refrence specimens of MANITU a first tendency is recognizable. The Charpy properties of the newly developed low activation 7-10% Cr-WVTa alloys are clearly better compared with the modified commerical 10-11% Cr-NiMoVNb steels. In the present report the pre-examinations are documented and the Charpy test results with unirradiated reference specimens are analysed and assessed. (orig.)

23855 (FZKA–5557) **Experimental determination of the thermal conductivity of liquid stainless steel.** Bober, M.; Singer, J. Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Inst. fuer Neutronenphysik und Reaktortechnik;

Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Projekt Nukleare Sicherheitsforschung. Feb 1995. 14p. (In German). Order Number DE95795759. Source: OSTI; NTIS (US Sales Only); INIS.

The thermal conductivity of liquid stainless steel was obtained from measurements of the melting depth, surface temperature and heat absorption on locally molten specimens. A Nd:YAG-laser pulse of 3 ms in length and of a uniformly flat power distribution in respect of space and time yielded a quasi-stationary surface melting of the specimen. The surface temperature was measured pyrometrically and the thickness of the refrozen molten layer was found out metallographically. The evaluation of the thermal conductivity of the stainless steel X10 NiCrMoTiB 15 15 (DIN-Nr. 1.4970) resulted in a mean value of 31 ± 9 Wm^{-1} K^{-1} in the temperature range of 1700-2500 K. (orig.)

23856 (GKSS–95/E/3) **Finite element analysis for detecting stress distributions and measuring the I-integral in a surface crack in a welded joint of a plate test piece and a pipe segment.** Dietrich, R.A. (GKSS-Forschungszentrum Geesthacht GmbH (Germany). Inst. fuer Gewaesserphysik). GKSS-Forschungszentrum Geesthacht GmbH (Germnay). 1995. 64p. (In German). Order Number DE95795736. Source: OSTI; NTIS (US Sales Only).

For evaluating the stresses of a plate specimen and a pipe segment with a defect by a surface crack in a welding joint, nonlinear finite element analyses are performed. The plate specimen is succumbed to a load by means of a bending moment or a tension. At the pipe segment a four-point bending moment can be found. The finite element analyses lead to knowledge about the stress distribution, the J-integral and the triaxiality ratio of the stress condition in the area of the crack front and about the opening of the surface crack. (orig.)

23857 (JAERI-Research–95-031) **Research on fretting corrosion behavior of structural materials used in nitric acid environments for spent fuel reprocessing . 2. Effect of nitric acid temperature on fretting corrosion behavior of zirconium.** Sakairi, Masatoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kiuchi, Kiyoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 34p. (In Japanese). Order Number DE95789321. Source: OSTI; NTIS; INIS.

Zirconium (Zr) is considered to be one of the promising candidate material applied for commercial spent fuel reprocessing plants. Because, it shows high corrosion resistance in highly oxidizing nitric acid solutions. However, the corrosion resistance is weaken under wear condition. Both rotating (type I) and reciprocal (type II) abrasion type fretting corrosion tests were used to study the fretting corrosion resistance of Zr in 3N HNO_3 at various temperature. From both test results, Zr showed high thickness loss rate. The thickness loss rate is increased with increasing the applied momentum, which is estimated from the values of abrasion speed and load. In type II tests, the thickness loss rate was increased with increasing temperature. It shows maximum value at boiling point. A possible reason for the low fretting corrosion resistance of Zr may be interpreted with based on the mechanical break along the crystal habit plane and the slow repassivation rate in boiling 3N HNO_3. (author).

23858 (JAERI-Research–95-032) **Corrosion fatigue behavior of zirconium in boiling nitric acid.** Motooka, Takafumi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kiuchi, Kiyoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 26p. (In Japanese). Order Number DE95789322. Source: OSTI; NTIS; INIS.

The corrosion fatigue behavior of zirconium in boiling nitric acid has been studied to evaluate the reliability of zirconium used in nuclear fuel reprocessing equipment. An apparatus designed for corrosion fatigue tests in boiling nitric acid was used. The crack growth rate of zirconium was measured as a function of the stress intensity factor using TDCB type specimens. After the tests, the fracture morphology was examined with a scanning electron microscope. The crack growth rate was influenced with the texture of specimens and the test environments. In air at room temperature, the crack growth rate at the longitudinal direction of specimens was faster than that of the transverse direction. Moreover, the crack growth rate in boiling nitric acid was more faster than that in air at room temperature. According to the fractographic examination, X-ray analysis, and so on, the observed results were interpreted with based on the crystal anisotropy on mechanical properties and the susceptibility to stress corrosion cracking in boiling nitric acid of zirconium. (author).

23859 (JAERI-Tech–95-017) **Joining technology development of advanced materials/SS304 by friction welding.** Tsuchiya, Kunihiko (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Kawamura, Hiroshi; Oyamada, Rokuro. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 79p. Order Number DE95789298. Source: OSTI; NTIS; INIS.

A friction welding is one of the most popular welding method for joint of different materials. In the JMTR(Japan Materials Testing Reactor), intensive studies have been made on various materials and stainless steel joints fabricated by friction welding method and used for structural materials as pressure boundaries of irradiation capsule against the primary coolant of the JMTR. Niobium alloy is one of advanced materials because of the heat resisting and low activation material. The friction welding can be applied to joints of niobium alloy/SS304. In the present work, the welding technique and characteristics of friction welded Nb1%Zr/SS304 were investigated under un-irradiated and irradiated specimens. The study items for Nb1%Zr/SS304 joints by friction welding are as follows: the measurement of tensile strength, torsion fatigue strength, burst strength and hardness, metallography and XMA analysis for neutron-un-irradiated specimens. The measurement of tensile strength and hardness, metallography and XMA analysis for neutron-irradiated specimens. The results obtained were as follows: A suitable fabricating condition were obtained from experiments for friction welding of Nb1%Zr/SS304. From un-irradiated data, tensile strength of Nb1%Zr/SS304 joints was equal to the strength of Nb1%Zr alloy. Fatigue strength of Nb1%Zr/SS304 joints was similar to the strength of Nb1%Zr alloy and burst positions by burst test were the parts of Nb1%Zr alloy. From post-irradiation examination, all specimens have been broken at the part of Nb1%Zr alloy, and the strength of irradiated specimens increased comparing with that of un-irradiated specimens. The hardness of irradiated specimens also increased comparing with that of un-irradiated specimens. (author).

23860 (LA-UR–95-1940) **Landau-Ginzburg model of interphase boundaries in CsCl-type ferroelastics due to M^-_5 mode instability: $LaAg_{1-x}In_x$.** Hatch, D.M. (Brigham Young Univ., Provo, UT (United States). Dept. of Physics); Saxena, A.; Barsch, G.R. Los Alamos National Lab., NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015277. Source: OSTI; NTIS; GPO Dep.

We have constructed a Landau-Ginzburg model of ferroelastic domain walls in the tetragonal phase of CsCl-type intermetallic compounds. This improper ferroelastic phase transition is driven by the condensation of a degenerate zone-edge phononmode of M^-_5 symmetry and can be described by a six-component order parameter. Analytic and numerical kink-type soliton solutions for the order parameter profile and the strain distribution are obtained for three different interphase boundaries: a twin boundary and two antiphase boundaries. The stability, merging and splitting of various domain types are also studied. Specifically, a symmetry-allowed product phase of I4/mmm (D^{17}_{4h}) symmetry has been experimentally observed in pseudobinary rare earth alloys of composition RAg_{1-I} In_I (R=La, Ce, Pr) and in related systems (YCu, LaCd).

23861 (LBF-TB–200(1994)) **Papers of the sixth LBF colloquium on March 1st and 2nd, 1994 in Darmstadt.** Buxbaum, O. (ed.); Rupp, A. (ed.). Fraunhofer-Institut fuer Betriebsfestigkeit (LBF), Darmstadt (Germany). 1994. . 327p. (In German). (CONF-9403173–: 6. colloquium of Fraunhofer-Institut fuer Betriebsfestigkeit (LBF), Darmstadt (Germany), 1-2 Mar 1994). Order Number DE95796279. Source: OSTI; NTIS (US Sales Only).

These proceedings contain 14 papers presented at the 6th LBF meeting at Darmstadt on 1 and 2 March 1994. Four subjects were covered: (1) New materials and surface coatings; (2) Load

assumptions and simulation; (3) Component inherent material behavior; and (4) Numerical methods and application. In an annex photos of eight poster presentations are shown. (CT)

23862 (LBF-TB–200(1994), pp. 169-197) **Strength behavior of welded joints under combined in-phase and phase-shifted multiaxial stresses.** Sonsino, C.M. Fraunhofer-Institut fuer Betriebsfestigkeit (LBF), Darmstadt (Germany). 1994. 327p. (In German). (CONF-9403173–: 6. colloquium of Fraunhofer-Institut fuer Betriebsfestigkeit (LBF), Darmstadt (Germany), 1-2 Mar 1994). In *Papers of the sixth LBF colloquium on March 1st and 2nd, 1994 in Darmstadt.* Order Number DE95796279. Source: OSTI; NTIS (US Sales Only).

Under this study center welded cross specimens made of the fine grained structural steel StE 290 and flange-to-tube joints made of the fine grained structural steel StE 460 with mechanically non-machined and machined welds were investigated in the range between 10^3 and 5.10^6 load cycles and a strength hypothesis was developed on the basis of local notch basic loads which describes the fatigue strength behavior of weldments under single-stage multiaxial loads with constant and variable main load directions or in-phase and phase-shifted loads. (orig./MM)

23863 (LBF-TB–200(1994), pp. 211-238) **Fatigue life prediction for integrally cast turbine wheels while taking into account short cracks using the nickel base alloy IN 713 C as an example.** Brandt, U.; Sonsino, C.M. Fraunhofer-Institut fuer Betriebsfestigkeit (LBF), Darmstadt (Germany). 1994. 327p. (In German). (CONF-9403173–: 6. colloquium of Fraunhofer-Institut fuer Betriebsfestigkeit (LBF), Darmstadt (Germany), 1-2 Mar 1994). In *Papers of the sixth LBF colloquium on March 1st and 2nd, 1994 in Darmstadt.* Order Number DE95796279. Source: OSTI; NTIS (US Sales Only).

The cast alloy IN 713 C (cast condition) frequently used in turbine wheels was used to determine fatigue strength results under quasi-operational conditions within the range of low cycle fatigue with the objective of transferring the initial crack and crack propagation behavior to notched specimens and later to turbine wheels, while taking into account an inhomogeneous stress and strain distribution, respectively. This transferability relates only to results below 600 C, because this temperature occurs in the critical region of the turbine wheel, the hub. (orig.)

23864 (LNF-P–95-013) **Influence of interstitial solutions (H, N) on cerium electronic state in Ce-Fe intermetallic compounds: X-ray Absorption Spectroscopy (XAS) study.** Chaboy, J. (Zaragoza Univ. (Spain). Inst. de Ciencia de los Materiales de Aragon); Marcelli, A.; Bozukov, L. Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Mar 1995. 26p. Order Number DE95789752. Source: OSTI; NTIS (US Sales Only).

It is presented an x-ray absorption spectroscopy (XAS) investigation performed at the L-edges of the rare-earth and at the K-edge of iron in the R-Fe intermetallic compounds (La, $Ce)_2Fe_{14}BH_\chi$ and $Ce_2Fe_{17}(H, N)_\chi$, to elucidate the role of the interstitial doping into the electronic and magnetic properties of these systems. Comparison with x-ray circular magnetic dichroism (XCMD) experiments has been carried out to clarify the localization of 4f magnetic moment at the Ce sites upon hydriding. Both XAS and XCMD results evidence the interplay between the structural and magnetic changes, that are associated to the modification of the hybridization between the Fe(3d) and Ce(5d) bands.

23865 (ORNL/SUB–87-SB154/03) **Pack cementation diffusion coatings for iron-base alloys.** Rapp, R.A. (Ohio State Univ., Columbus, OH (United States). Dept. of Materials Science and Engineering). Oak Ridge National Lab., TN (United States); Ohio State Univ., Columbus, OH (United States). Dept. of Materials Science and Engineering. Feb 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013450. Source: OSTI; NTIS; GPO Dep.

With the aid of computer-assisted calculations of the equilibrium vapor pressures in halide-activated cementation packs, processing conditions have been identified and experimentally verified for the codeposition of two or more alloying elements in a diffusion coating on a variety of steels. The Cr-Si ferrite layers have proven to be very resistant to high temperature cyclic oxidation and to pitting in aqueous solutions. The process has been patented, and is being transferred for industrial application, e.g. for water walls of utility boilers, etc. In the proposed extension of this project, the use of mixed pure metal powders in the pack will be extended to achieve similar ferrite Fe-Cr-Al coatings with excellent oxidation resistance, with the eventual transfer of the technology to industry. In other recent studies, Ni-base alloy rods were aluminized by the halide-activated pack cementation process to bring their average composition to that for the ORNL-developed Ni_3Al, for use as a welding rod. A similar effort to develop a welding rod for the ORNL Fe_3Al alloy did not yield reproducible coating compositions or growth kinetics. The continued effort to produce Duriron-type (Fe-18Si-5Cr) coatings on steels was not successful. Literature for the intrinsic diffusion coefficients suggests that this task cannot be achieved.

23866 (SAND–95-0841C) **Monitoring of MOCVD reactants by UV absorption.** Baucom, K.C.; Killeen, K.P.; Moffat, H.K. Sandia National Labs., Albuquerque, NM (United States). [1995]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950429–1: 7. biennial workshop on organometallic vapor phase epitaxy, Fort Meyers, FL (United States), 2-6 Apr 1995). Order Number DE95014605. Source: OSTI; NTIS; GPO Dep.

In this paper, we describe how UV absorption measurements can be used to measure the flow rates of metal organic chemical vapor deposition (MOCVD) reactants. This method utilizes the calculation of UV extinction coefficients by measuring the total pressure and absorbance in the neat reactant system. The development of this quantitative reactant flow rate monitor allows for the direct measurement of the efficiency of a reactant bubbler. We demonstrate bubbler efficiency results for TMGa, and then explain some discrepancies found in the TMAl system due to the monomer to dimer equilibrium. Also, the UV absorption spectra of metal organic and hydride MOCVD reactants over the wavelength range 185 to 400 nm are reported.

23867 (SAND–95-1287C) **Applications of microstructural modeling.** Holm, E.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506212–1: Workshop on rational design and processing of advanced ceramics, La Jolla, CA (United States), 21-23 Jun 1995). Order Number DE95014602. Source: OSTI; NTIS; GPO Dep.

This paper describes the use of computerized simulation to model microstructures of various materials.

23868 (SAND–95-8502C) **Modeling the segregation of hydrogen to lattice defects in nickel.** Angelo, J.E.; Moody, N.R.; Baskes, M.I. Sandia National Labs., Livermore, CA (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940945–8: 5. international conference on hydrogen effects on material behavior, Moran, WY (United States), 11-15 Sep 1994). Order Number DE95010759. Source: OSTI; NTIS; GPO Dep.

In order to better understand the effect of hydrogen on the fracture behavior of nickel, this study uses the embedded atom method (EAM) to model the segregation of hydrogen to lattice defects in nickel. The dislocations modeled include an edge, a screw, and a Lomer dislocation in the locked configuration, i.e. the Lomer-Cottrell Cock (LCL). Several coincident site lattice boundaries are also investigated, these being the $\Sigma3(112)$ and $\Sigma11(113)$ tilt boundaries. It will be shown that the trap site energies in the vicinity of both the edge and screw dislocations is only about 0.1 eV while for the LCL and all of the grain boundaries the maximum trap site energy in the vicinity of the defect is on order 0.3 eV. Using a Monte-Carlo method to a impose a hydrogen environment produces much stronger segregation of hydrogen to the deeper traps. When compared to recent experimental studies showing that a binding energy between 0.3-0.4 eV is required for trap site controlled fracture in IN903, it can be concluded that the embrittlement process is most probably associated with trapping of hydrogen to the Lomer-Cottrell Locks.

23869 (SAND–95-8513C) **A model of phase transformation plasticity.** Bammann, D.J.; Prantil, V.C.; Lathrop, J.F. Sandia

National Labs., Livermore, CA (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9509118–3: Modeling of casting, welding and advanced solidification processes 7, London (United Kingdom), 10-15 Sep 1995). Order Number DE95010699. Source: OSTI; NTIS; GPO Dep.

To numerically describe the welding of high strength steels, an accurate constitutive model must be used for both the filler as well as base material. For such multiphase materials, a consistent model must be developed to account for the response of each phase and the volumetric differences between the phases during transformation. We have proceeded with this task by initially considering two phases, austenite and martensite. The response of each phase is modeled using the previously developed state variable model of Bammann. We assume that each continuum point is occupied by both phases and introduce the volume fraction as an independent variable. The phases interact through a stress field which acts as a forward stress in the softer austenite, thereby introducing additional plastic flow which has been previously referred to as transformation induced plasticity (TRIP). Simultaneously there is a backward stress in the harder phase retarding the plastic flow of that phase. To satisfy equilibrium between the phases, the average stress at the point is assumed to satisfy a volume fraction weighted rule of mixtures while the average strain is imposed on each phase. Evolution equations are assumed for the transformation kinetics and interaction stress to complete the system. This approach eliminates the need for introduction of a transformation plasticity strain rate term and lends itself to efficient numerical implementation into finite element codes. Simulation of a simple quenching boundary value problem will be discussed.

23870 (SAND–95-8525C) **Temperature-dependent structure of a(10$\bar{1}$) superdislocations in Ni_3Al.** Chrzan, D.C. (Sandia National Labs., Livermore, CA (United States)); Foiles, S.M.; Daw, M.S.; Mills, M.J. Sandia National Labs., Livermore, CA (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941144–153: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95010755. Source: OSTI; NTIS; GPO Dep.

The dissociated structure of the a(101) superdislocations in Ni_3Al is predicted as a function of temperature. The temperature dependence of the relevant fault Helmholtz free energies and elastic constants are calculated within the quasiharmonic approximation using the embedded atom method, Results of these calculations are then incorporated into anisotropic elasticity theory-based calculations of the dissociation distances. The cross-slip activation enthalpy is estimated and found to decrease by 24% at 600 K when compared with its 0 K value. The calculations point to the need to perform experiments to address this temperature dependence.

23871 (SAND–95-8534C) **Analysis of buckling distortion in bead-on-plate Ti 6-4 welds.** Ortega, A.R. (Sandia National Labs., Livermore, CA (United States)); Lathrop, J.F.; Corderman, R.E.; Fuchs, E.A.; Hess, B.V.; Mahin, K.W.; Giamei, A.F. Sandia National Labs., Livermore, CA (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9509118–4: Modeling of casting, welding and advanced solidification processes 7, London (United Kingdom), 10-15 Sep 1995). Order Number DE95010763. Source: OSTI; NTIS; GPO Dep.

Three-dimensional thermal-mechanical analyses of autogenous GTA bead-on-plate welds of Ti 6Al-4V have been performed. Sequential coupling of the thermal and mechanical analyses was employed. Predicted time-dependent temperature distributions from the thermal analysis code, JACQ3D, were provided as input to ATAQUS for the mechanical analysis. The heat input to the workpiece is modeled as a traveling Gaussian heat flux distribution. Thermal losses from the workpiece due to convection, radiation, and metal evaporation are included in the analysis. The material model is a bilinear temperature-dependent elastic-plastic model. The buckling distortion observed in the post-weld workpiece was successfully modeled using shell finite elements. A complete set of experimental data was obtained in this study to validate the numerical model. Computed thermal results compared favorably with measured temperatures (thermocouples and infrared thermography) and fusion zone shape. Real-time displacement data obtained from video cameras agreed well with predicted mechanical results. In particular, the initiation of buckling, which was observed in the displacement data, was captured in the simulation.

23872 (UCRL-ID–118664) **The effect of actinide thin films on the electronic structure and reactivity of various elements.** Gouder, T.; Colmenares, C. Lawrence Livermore National Lab., CA (United States). 8 Dec 1994. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015845. Source: OSTI; NTIS; GPO Dep.

This report summarizes the experimental work carried out at the Lawrence Livermore National Laboratory on the electronic structure and reactivity of uranium thin films on Pd, Pt, Si, graphite, Cu, and Au substrates from 1990 to 1993. The U-Pd system was studied in the most detail because it was the first to be chosen right after the completion of the experimental equipment. We first studied and characterized clean U overlayers and the possible surface reactions between this metal and the substrates studied. We then subjected these systems to reactive conditions such as heating and adsorbing corrosive gases (O_2, CO, CO_2, and C_2H_4). Finally we investigated the diffusion of U metal and some of its compounds into the substrates. A new technique was developed, based on Auger Electron Spectroscopy, to follow in real time the diffusion of U overlayers into the substrate. The temperature of the sample is ramped linearly up to 900°C while following the Auger peak intensities of the two components for a given system. Diffusion rates are obtained by differentiating the measured intensity curves, then peaks result corresponding to diffusion processes with different activation energies. This technique bears a strong similarity to thermal desorption spectroscopy (TDS), where the sample is heated linearly and the rate of desorption is measured as a function of temperature and heating rate.

23873 (UCRL-ID–119089) **Broad-band characterization of the complex permittivity and permeability of materials.** Avalle, C.A. (Lawrence Livermore National Lab., CA (United States). Electromagnetics and Diagnostics Group). Lawrence Livermore National Lab., CA (United States). Nov 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014372. Source: OSTI; NTIS; GPO Dep.

By employment of state-of-the-art Vector Network Analyzers, and other wide-band measurement equipment and techniques, the authors have the capability of measuring the complex permittivity and permeability of materials, for frequencies ranging from several tens of Kilohertz up to several Gigahertz. Measurement methods and equations for numerical determination are based on recommendations by the National Institute of Standards and Technology (NIST). Types of materials which can be analyzed are dielectric or magnetic RF and radar absorbers; thin sheets, paints, coatings; castable resins; foams and low density materials; ceramics and ferrites; carbonized fabrics; and composites.

23874 (UCRL-ID–120373) **Investigation of the reaction rates between uranium and liquid aluminum.** Strum, M.J. (Lawrence Livermore National Lab., CA (United States)); Sedillo, E.; Smugeresky, J. Lawrence Livermore National Lab., CA (United States). 5 May 1995. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015951. Source: OSTI; NTIS; GPO Dep.

A limited study consisting of scoping experiments was carried out to determine if a uranium-niobium alloy was weakly or strongly resistant to penetration by liquid aluminum alloy 6061. Our investigation was limited to temperatures between 700°and 900°C and carried out using small cylindrical coupons of U-6wt.%Nb and unalloyed U in unsaturated molten aluminum and aluminum alloy 6061 baths. The results indicate that indeed, significant dissolution of uranium into molten aluminum occurs and in relatively short times. The diameters of U-6wt.%Nb test cylinders immersed in unsaturated Al-6061 decreased linearly with time at 700°C, 800°C, and 900°C at rates of 1.14 mm/h, 3.0 mm/h, and 3.5 mm/h, respectively. However, we have found that the reaction rates were significantly reduced by the alloying elements niobium and magnesium. These results suggest that a more detailed investigation could lead to a predictive capability for control of these reaction

rates. In unalloyed U, the rate of U dissolution increased by up to a factor of ten relative to that in U- 6wt.%Nb. In both materials, the dissolution of the U core was found to occur by advance of a continuous intermetallic layer, which redissolves into the unsaturated liquid Al bath. The Nb additions resulted in the formation of a thick transition layer composed of intermetallic and U-saturated liquid. In unalloyed U, however, the transition layer was largely reduced in thickness, allowing unsaturated liquid adjacent to the continuous intermetallic layer. Another important variable identified was the influence of surface condition on interface reactivity. At 900°C, liquid attack was completely absent over large regions of U-6wt.% Nb samples immersed in Al-6061. Surface analysis by EDX identified the presence of up to 24 at.% Mg in unattacked areas.

23875 (UCRL-JC–117772) **A parallel 3D ALE code for metal forming analyses.** Neely, R.; Couch, R.; Dube, E.; Futral, S. Lawrence Livermore National Lab., CA (United States). 30 Jan 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506144–5: 5. international conference on numerical methods in industrial forming processes (NUMIFORM), Ithaca, NY (United States), 18-21 Jun 1995). Order Number DE95011739. Source: OSTI; NTIS; GPO Dep.

A three-dimensional arbitrary Lagrange-Eulerian (ALE) code is being developed for use as a general purpose tool for metal forming analyses. The focus of the effort is on the processes of forging, extrusion, casting and rolling. The ALE approach was chosen as an efficient way to deal with the large deformations and complicated flows associated with these processes. A prototype version of the software package, ALE3D, exists and is being applied to the enumerated processes. The development of the code is being driven by the dual constraints of portability and extensibility. A general purpose simulation tool must be capable of mining on a variety of platforms from single processor workstations to massively parallel platforms. It might also be configured to easily accommodate new physical models and parameters. The focus of this paper will be on computer science issues, with parallelization being the dominant issue. Long term goals will be described, as well as current status.

23876 (UCRL-JC–119347) **Development of a sensor and control system for the production of titanium matrix composites.** Berzins, L.V. (and others); McClelland, M.A.; Anklam, T.M. Lawrence Livermore National Lab., CA (United States). Mar 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. ARPA Contract MDA972-90-C-0018. (CONF-950833–2: 10. international conference on composite materials, Whistler (Canada), 14-18 Aug 1995). Order Number DE95014162. Source: OSTI; NTIS; GPO Dep.

Titanium matrix composites promise to dramatically increase the thrust-to-weight ratio of gas turbine engines. Electron Beam Physical Vapor Deposition (EB-PVD) is ideal for coating fibers if issues with composition control can be worked out. LLNL is developing a control system based on Diode Laser Absorption Spectroscopy (DLAS) for the deposition of titanium orthorhombic alloys. In this paper, the important features and components of a DLAS control system are reviewed and a methodology for selecting the appropriate atomic transitions is described. Data characterizing the diagnostic performance as well as information on potential control strategies is presented. Finally, applications of this diagnostic to other alloy systems are discussed.

23877 (UCRL-JC–119687) **Development of a bipolar cell for electrochemical production of lithium.** Cooper, J.F. (Lawrence Livermore National Lab., CA (United States)); Mack, G.; Peterman, K.; Weinland, S.; McKenzie, P. Lawrence Livermore National Lab., CA (United States). 22 Feb 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950518–7: 187. meeting of the Electrochemical Society, Reno, NV (United States), 21-26 May 1995). Order Number DE95013456. Source: OSTI; NTIS; GPO Dep.

Lithium metal can be electrolytically refined from aqueous solutions of its compounds by partial reduction to form a lithium amalgam, followed by reduction of the amalgam to liquid lithium in a molten salt cell at 225 C. A bipolar cell (with a continuous, amalgam electrode circulating between the aqueous and salt cells) was designed, constructed and successfully tested on the bench scale, as a proof of principle of an efficient, safe and low-temperature alternative to existing processes.

23878 (WAPD-T–3054) **Irradiation-assisted stress corrosion cracking of HTH Alloy X-750 and Alloy 625.** Bajaj, R.; Mills, W.J.; Lebo, M.R.; Hyatt, B.Z.; Burke, M.G. Westinghouse Electric Corp., West Mifflin, PA (United States). Bettis Atomic Power Lab. [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC11-93PN38195. (CONF-950816–1: 7. NACE international symposium on environmental degradation of materials in nuclear power plants: water reactors, Breckenridge, CO (United States), 6-10 Aug 1995). Order Number DE95014553. Source: OSTI; NTIS; INIS; GPO Dep.

In-reactor testing of bolt-loaded compact tension specimens was performed in 360 C water. New data confirms previous results that high irradiation levels reduce SCC resistance in Alloy X-750. Low boron heats show improved IASCC (irradiation-assisted stress corrosion cracking). Alloy 625 is resistant to IASCC. Microstructural, microchemical, and deformation studies were carried out. Irradiation of X-750 caused significant strengthening and ductility loss associated with formation of cavities and dislocation loops. High irradiation did not cause segregation in X-750. Irradiation of 625 resulted in formation of small dislocation loops and a fine body-centered-orthorhombic phase. The strengthening due to loops and precipitates was apparently offset in 625 by partial dissolution of γ precipitates. Transmutation of boron to helium at grain boundaries, coupled with matrix strengthening, is believed to be responsible for IASCC in X-750, and the absence of these two effects results in superior IASCC resistance in 625.

23879 (WAPD-T–3055) **Stress corrosion cracking behavior of Alloy 600 in high temperature water.** Webb, G.L.; Burke, M.G. Westinghouse Electric Corp., West Mifflin, PA (United States). Bettis Atomic Power Lab. [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC11-93PN38195. (CONF-950816–2: 7. NACE international symposium on environmental degradation of materials in nuclear power plants: water reactors, Breckenridge, CO (United States), 6-10 Aug 1995). Order Number DE95014554. Source: OSTI; NTIS; INIS; GPO Dep.

SCC susceptibility of Alloy 600 in deaerated water at 360 C (statically loaded U-bend specimens) is dependent on microstructure and whether the material was cold-worked and annealed (CWA) or hot-worked and annealed (HWA). All cracking was intergranular, and materials lacking grain boundary carbides were most susceptible to SCC initiation. CWA tubing materials are more susceptible to SCC initiation than HWA ring-rolled forging materials with similar microstructures (optical metallography). In CWA tubing materials, one crack dominated and grew to a visible size. HWA materials with a low hot-working finishing temperature (<925 C) and final anneals at 1010-1065 C developed both large cracks (similar to those in CWA materials) and small intergranular microcracks detectable only by destructive metallography. HWA materials with a high hot-working finishing temperature (>980 C) and a high-temperature final anneal (>1040 C), with grain boundaries that are fully decorated, developed only microcracks in all specimens. These materials did not develop large, visually detectable cracks, even after more than 300 weeks exposure. A low-temperature thermal treatment (610 C for 7h), which reduces or eliminates SCC in Alloy 600, did not eliminate microcrack formation in high temperature processed HWA materials. Conventional metallographic and analytical electron microscopy (AEM) were done on selected materials to identify the factors responsible for the observed differences in cracking behavior. Major difference between high-temperature HWA and low-temperature HWA and CWA materials was that the high temperature processing and final annealing produced predominantly "semi-continuous" dendritic M_7C_3 carbides along grain boundaries with a minimal amount of intragranular carbides. Lower temperature processing produced intragranular M7C3 carbides, with less intergranular carbides.

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Refer also to citation(s) 23161, 23714, 23778, 23834, 23842, 23851, 23867, 23873, 23915, 23918, 24884

23880 (ANL/ET/CP–85328) **Automated laser scatter detection of surface and subsurface defects in Si_3N_4 components.** Steckenrider, J.S. (Argonne National Lab., IL (United States). Energy Technology Div.). Argonne National Lab., IL (United States); Solar Turbines, Inc., San Diego, CA (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-92CE40960. (CONF-950129–10: 19. annual conference on advanced ceramics, materials and structures, Cocoa Beach, FL (United States), 9-12 Jan 1995). Order Number DE95013498. Source: OSTI; NTIS; GPO Dep.

Silicon Nitride (Si_3N_4) ceramics are currently a primary material of choice to replace conventional materials in many structural applications because of their oxidation resistance and desirable mechanical and thermal properties at elevated temperatures. However, surface or near-subsurface defects, such as cracks, voids, or inclusions, significantly affect component lifetimes. These defects are currently difficult to detect, so a technique is desired for the rapid automated detection and quantification of both surface and subsurface defects. To address this issue, the authors have developed an automated system based on the detection of scattered laser light which provides a 2-D map of surface or subsurface defects. This system has been used for the analysis of flexure bars and button-head tensile rods of several Si_3N_4 materials. Mechanical properties of these bars have also been determined and compared with the laser scatter results.

23881 (ANL/ET/CP–86059) **Development of nondestructive evaluation methods and prediction of effects of flaws on the fracture behavior of structural ceramics.** Ellingson, W.A. (and others); Singh, J.P.; Sivers, E.A. Argonne National Lab., IL (United States). Apr 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505204–4: 9, annual conference on fossil energy materials, Oak Ridge, TN (United States), 16-18 May 1995). Order Number DE95013783. Source: OSTI; NTIS; GPO Dep.

Continuous fiber ceramic matrix composites are being developed for turbine engine components, heat exchangers, and hot-gas filters in fossil energy systems. Reliable application requires nondestructive evaluation (NDE) methods that provide data for quality assurance and inputs to life time prediction models and that aid in process development. NDE developments at Argonne have focused on methods to assess density distribution, fiber orientation (for mechanical properties), and defect detection in both SiC/SiC and $A1_2O_3/A1_2O_3$ materials. and that also assess the chemical state at fiber/matrix interfaces. 2-D cloth lay-up and 3-D weave CVI-infiltrated SiC/SiC specimens were studied by X-ray imaging methods now under development. Microfocus X-ray computerized tomography (MXCT) methods are being developed to provide these data. Multinuclear Nuclear Magnetic Resonance spectroscopy (13C, 29Si, and 11B) is under development for quantizing B content at fiber/matrix interfaces. Magic angle spinning techniques on SiC/SiC specimens with different coating thicknesses showed that quantification of B at the Interface is achievable. NDE data are being coupled to room- and elevated-temperature fracture studies to evaluate effects of fiber orientation and fiber coating thickness on resulting flaw morphology and mechanical properties of Nicalon-fiber-reinforced SiC matrix composites. Specifically, composites with fiber cloth lay-up sequences of varying coating thicknesses were evaluated. For room-temperature mechanical evaluation, composites with carbon-fiber coating thicknesses of 0 and 0.2 μm were used, while elevated-temperature studies used composites with a coating thickness of 0.4 μm. Composites with uncoated fibers failed in a brittle mode, while composites with 0.2 μm fiber coating showed noncatastrophic failure.

23882 (ANL/ITD/PC–86699) **Tribology and coatings.** Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95013396. Source: OSTI; NTIS; GPO Dep.

The future use of fuel-efficient, low-emission, advanced transportation systems (for example, those using low-heat-rejection diesel engines or advanced gas turbines) presents new challenges to tribologists and materials scientists. High service temperatures, corrosive environments, and extreme contact pressures are among the concerns that make necessary new tribological designs, novel materials, and effective lubrication concepts. Argonne is working on methods to reduce friction, wear and corrosion, such as soft metal coatings on ceramics, layered compounds, diamond coatings, and hard surfaces.

23883 (CONF-941144–155) **Synthesis and characterization of a metastable $(SiC)_3N_4$ phase.** Uslu, C. (Georgia Inst. of Tech., Atlanta, GA (United States). School of Materials Science and Engineering); Park, B.; Poker, D.B. Oak Ridge National Lab., TN (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States);Georgia Inst. of Tech., Atlanta, GA (United States). DOE Contract AC05-84OR21400. From 1994 fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 28 Nov - 2 dec 1994. Order Number DE95008972. Source: OSTI; NTIS; GPO Dep.

A metastable C-SI-N compound has been synthesized by high dose N^+ implantation into polycrystalline β-SiC (cubic phase). The thin films formed upon 100 keV implantation were characterized with respect to various ion doses and target temperatures. X-ray diffraction with a position-sensitive detector and cross-sectional transmission electron microscopy revealed that the as-implanted surfaces contained $\sim$ 0.15 μm thick continuously-buried amorphous layers. Rutherford backscattering spectroscopy showed that the peak concentration of nitrogen saturated up to approximately 54 at. % with increasing doses, suggesting a new phase formation.

23884 (CONF-941144–164) **Growth and properties of $PbTiO_3$/PLT heterostructures.** Kim, Yeongkwan (Georgia Institute of Technology, Atlanta, GA (United States). School of Physics); Han, Y.H.; Erbil, A. Oak Ridge National Lab., TN (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1994 fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 28 Nov - 2 dec 1994. Order Number DE95013988. Source: OSTI; NTIS; GPO Dep.

Ferroelectric superlattice structures composed of three-dimensionally epitaxial $PbTiO_3$ and PLT thin films have been successfully grown on $SrTiO_3$ substrates by metalorganic chemical vapor deposition. The modulation structures were confirmed by θ-2θ XRD, and the excellent in-plane orientational relationship between the superlattice film and the substrate by (100), (110), and (111)-pole figures. The ϕ-scans through the (110) and (111) reflections were used as additional evidence for three-dimensional epitaxy. The substrate dependence of the epitaxial orientation of PLT and $PbTiO_3$ single-layered thin films was investigated. $PbTiO_3$ thin films with very high crystalline perfection can be successfully grown on $KTaO_3$ substrates.

23885 (CONF-9411236–1) **Long-term testing.** Ferber, M.; Graves, G.A. Jr. Oak Ridge National Lab., TN (United States). [1994]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Advanced turbine systems (ATS) annual review meeting; Washington, DC (United States); 8-11 Nov 1994. Order Number DE95013979. Source: OSTI; NTIS; GPO Dep.

Land-based gas turbines are significantly different from automotive gas turbines in that they are designed to operate for 50,000 h or greater (compared to 5,000–10,000 h). The primary goal of this research is to determine the long-term survivability of ceramic materials for industrial gas turbine applications. Research activities in this program focus on the evaluation of the static tensile creep and stress rupture (SR) behavior of three commercially available structural ceramics which have been identified by the gas turbine manufacturers as leading candidates for use in industrial gas turbines. For each material investigated, a minimum of three temperatures and four stresses will be used to establish the stress and temperature sensitivities of the creep and SR behavior. Because existing data for many candidate structural ceramics are limited to testing times less than 2,000 h, this program will focus on extending these data to times on the order of 10,000 h, which represents the lower limit of operating time anticipated for ceramic blades and vanes in gas turbine engines. A secondary goal of the program will be to investigate the possibility of enhancing life prediction estimates by combining interrupted tensile SR tests and tensile dynamic fatigue tests in which tensile strength is measured as a

function of stressing rate. The third goal of this program will be to investigate the effects of water vapor upon the SR behavior of the three structural ceramics chosen for the static tensile studies by measuring the flexural strength as a function of stressing rate at three temperatures.

23886 (CONF-950401–19) **Sintering of ceramics using low frequency rf power.** Caughman, J.B.O.; Hoffman, D.J.; Baity, F.W.; Akerman, M.A.; Forrester, S.C.; Kass, M.D. Oak Ridge National Lab., TN (United States). [1995]. 8p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From 97. annual meeting of the American Ceramic Society; Cincinnati, OH (United States); 30 Apr - 1 may 1995. Order Number DE95014274. Source: OSTI; NTIS; INIS; GPO Dep.

Sintering with low frequency rf power (~50 MHz) is a new technique with unique capabilities that has been used to sinter a variety of ceramic materials, including zirconia-toughened alumina, alumina, silicon carbide, and boron carbide. Processing with low frequencies offers many advantages compared to processing with conventional microwave frequencies (915 MHz and 2.45 GHz). Because of the longer wavelength, the rf electric field penetrates materials more than microwaves. This effect allows the processing of a wider variety of materials and allows for an increase in the physical size of the material being processed. In addition, the material is heated in a single mode cavity with a uniform electric field, which reduces the occurrence of hot-spot generation and thermal runaway effects. This technique has been used to sinter large crack-free alumina samples (3 inch square) to > 97% density. The sintering and/or annealing of a number of carbide materials has been demonstrated as well, including silicon carbide, boron carbide, tungsten carbide, and titanium carbide.

23887 (CONF-9504181–1) **GELCASTING: From laboratory development toward industrial production.** Omatete, O.O.; Janney, M.A.; Nunn, S.D. Oak Ridge National Lab., TN (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States);National Inst. of Standards and Technology, Gaithersburg, MD (United States). DOE Contract AC05-84OR21400. From International conference on shaping of advanced ceramics; Mol (Belgium); 25-27 Apr 1995. Order Number DE95014267. Source: OSTI; NTIS; GPO Dep.

Gelcasting, a ceramic forming process, was developed to overcome some of the limitations of other complex-shape forming techniques such as injection molding and slip casting. In gelcasting, a concentrated slurry of ceramic powder in a solution of organic monomers is poured into a mold and then polymerized in-situ to form a green body in the shape of the mold cavity. Thus, it is a combination of polymer chemistry with slip processing and represents minimal departure from standard ceramic processing. The simplicity of the process has attracted industrial partners and by collaboration between them and the developers, the process is being advanced from the laboratory toward industrial production.

23888 (CONF-9505237–1) **Branches on the family tree: Superconductivity in epitaxial films of "first-in-line" descendants of the parent compound $SrCuO_2$.** Feenstra, R. (and others); Budai, J.D.; Norton, D.P. Oak Ridge National Lab., TN (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From High Temperture Superconductor (HTS) workshop on applications and new materials; Enschede (Netherlands); 8-10 May 1995. Order Number DE95014272. Source: OSTI; NTIS; GPO Dep.

The defect-induced carrier doping in epitaxial films of the parent compound $SrCuO_2$ is reviewed. Two superconducting descendants were synthesized by expanding the role of natural defects in the parent $SuCuO_2$ films, namely, the Ruddlesheim-Popper phases $Sr_{n+1}Cu_nO_{2n+1}$ and a nonstoichiometric variant of the oxycarbonate $Sr_2CuO_2(CO_3)$. The synthesis and structures are described.

23889 (DOE/MC/30244–95/C0481) **A method for measuring non-linear elastic properties of thermal barrier coatings.** Johnson, C.A.; Ruud, J.A.; Kaya, A.C.; deLorenzi, H.G. General Electric Co., Schenectady, NY (United States). Corporate Research and Development Center. [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-93MC30244. (CONF-9509182–1: 1995 National thermal spray conference, Houston, TX (United States), 11-15 Sep 1995). Order Number DE95012913. Source: OSTI; NTIS; GPO Dep.

Accurate characterization of the elastic properties of thermal barrier coatings (TBC's) is important for failure prediction. Thermally sprayed coatings often exhibit anisotropic and nonlinear elastic properties due to the coating microstructure that results from the thermal spray process. A method was developed for determining the elastic behavior of TBC's on substrates by measuring the in-plane modulus as a function of residual coating stress. The in-plane modulus was determined by resonant frequency measurement, and the residual stress was measured from the substrate curvature. The residual stress was varied both by increasing the temperature of the TBC and substrate and by applying compressive plastic strain to the metal substrate. The stress-strain behavior of the TBC was derived from the data for modulus versus residual stress, and significant nonlinear elastic behavior was observed.

23890 (DOE/OR/22041–T2) **Low temperature fabrication from nano-size ceramic powders.** Gonzalez, E.J. (and others); Piermarini, G.J.; Hockey, B. National Inst. of Standards and Technology (MSEL), Gaithersburg, MD (United States). Ceramics Div. [1995]. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-92OR22041. Order Number DE95013505. Source: OSTI; NTIS; GPO Dep.

The objective of the compaction process is to produce a dense green-state compact from a nanosize powder that subsequently can be sintered at high temperatures to form a dense ceramic piece. High density in the green-state after pressing is of primary importance for achieving high densities after sintering. Investigation of the compaction behavior of ceramic powders, therefore, is an important part of characterization of raw ceramic powders and evaluation of their compaction behavior, analysis of interaction between particles, and the study of microstructure of green body (unsintered) during pressure-forming processes. The compaction of nanosize ceramic particles into high density green bodies is very difficult. For the nanosize materials used in this study (amorphous Si_3N_4 and γ Al_2O_3), there is no evidence by TEM of partial sintering after synthesis. Nevertheless, strong aggregation forces, such as the van der Waals surface forces of attraction, exist and result in moderate precursor particle agglomeration. More importantly, these attractive surface forces, which increase in magnitude with decreasing particle size, inhibit interparticle sliding necessary for particle rearrangement to denser bodies during subsequent compaction. Attempts to produce high density green body compacts of nanosize particles, therefore, generally have been focused on overcoming these surface forces of attraction by using either dispersive fluids or high pressures with or without lubricating liquids. In the present work, the use of high pressure has been employed as a means of compacting nanosize powders to relatively high green densities.

23891 (DOE/PC/93219–T5) **Novel carbon-ion fuel cells. First quarter 1995 technical progress report.** Cocks, F.H.; LaViers, H. Duke Univ., Durham, NC (United States). Dept. of Mechanical Engineering and Materials Science. 18 Apr 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93PC93219. Order Number DE95015606. Source: OSTI; NTIS; GPO Dep.

Research continued on task 2, the measurements on carbides with the fluorite structure. There are twelve known carbides of the fluorite structure with transition temperatures from 350-1450 C. Small quantities of these carbides in powder form will be purchased when commercially available. Pellets pressed from powder within an inert atmosphere will be made, CVI treated, and tested as described in Task No. 1. Pure carbides will be tested first, followed by carbides doped with impurities of different electrical valences whose atomic radii are favorable for solubility in the carbide lattice structure. Dopants will be introduced either during the chemical formation of the carbide, by mix and sinter diffusion, or by high energy ion bombardment of the powder prior to pelletization. The approximate time period for completion of Task No. 2 is twelve months. Investigations have been hampered by equipment failures. Progress is described.

23892 (FhG-IWM-W–2/95) **Mechanical behaviour during sintering - diffusion models and their verification for ZrO_2.**

Zipse, H. Fraunhofer-Institut fuer Werkstoffmechanik, Freiburg im Breisgau (Germany). Feb 1995. 156p. (In German). Order Number DE95795878. Source: OSTI; NTIS (US Sales Only).

The report describes attempts for modelling of the mechanical behaviour during solid-phase sintering. The work comprises the development of a theoretical model, sintering experiments with externally applied loads, and simulation calculations of sintering experiments in order to compare the theoretical and experimental values. A model of the central sintering stage based on diffusion processes is derived from microscopic assumptions, using a constitutive formulation with the three parameters: Compression viscosity, stearing viscosity, and sintering stress. Sintering forming experiments were carried out on tetragonally stabilized zirconium dioxide in order to determine the model parameters and to compare different models. A cylindrical powder preform is exposed to pressure on its front face during sintering. The diameter and height of the cylinder are scanned permanently during sintering, and the radial and axial strain rate are derived from these data. (orig./RHM)

23893 (JAERI-Tech–95-009) **Trial fabrication and preliminary characterization of electrical insulator for liquid metal system.** Nakamichi, Masaru (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Kawamura, Hiroshi; Oyamada, Rokuro. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 50p. Order Number DE95789300. Source: OSTI; NTIS; INIS.

In the design of the liquid metal blanket, MHD pressure drop is one of critical issues. Ceramic coating on the surface of structural material is considered as an electrical insulator to reduce the MHD pressure drop. Ceramic coating such as Y_2O_3 is a promising electrical insulator due to its high electrical resistivity and good compatibility with liquid lithium. This report describes the trial fabrication and preliminary characterization of electrical insulator for a design study of the liquid metal system. From the results of trial fabrication and preliminary characterization, it is concluded that densified atmospheric plasma spray Y_2O_3 coating with 410SS undercoating between 316SS substrate and Y_2O_3 coating is suitable for Y_2O_3 coating fabrication. (author).

23894 (LA-UR–95-1324) **Relationships between processing temperature and microstructure in isothermal melt processed Bi-2212 thick films.** Holesinger, T.G.; Phillips, D.S.; Willis, J.O.; Peterson, D.E. Los Alamos National Lab., NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-941013–38: Applied superconductivity conference, Boston, MA (United States), 16-21 Oct 1994). Order Number DE95012070. Source: OSTI; NTIS; GPO Dep.

The microstructure and phase assemblage of isothermal melt processed (IMP) $Bi_2Sr_2CaCu_2O_y$ (Bi-2212) thick films have been evaluated. Results from compositional analysis and phase identification indicate that the characteristics of the partial melt greatly influence the microstructural and chemical development of the thick films. The highest critical current densities were obtained in films processed below 800°C where the partial melt uniformly coats the substrate without excessive phase segregation.

23895 (PNL-SA–26298) **Processing & properties $La_{1-x}A_xCo_{1-y}Fe_yO_3$(A = Sr, Ca) perovskites.** Stevenson, J.W. (and others); Armstrong, T.R.; Pederson, L.R. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950401–17: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95014170. Source: OSTI; NTIS; GPO Dep.

Selected compositions within the system $La_{1-x}A_xCo_{1-y}Fe_yO_{3-\delta}$(A = Sr, Ca) were prepared by combustion synthesis and characterized by XRD, TGA, electrical conductivity, and oxygen permeation measurements. Substantial weight loss (due to loss of lattice oxygen) was observed in some compositions at high temperatures. For Sr containing materials, this weight loss increased with increasing Sr content. A substantial decrease in electronic conductivity was observed at high temperatures in Sr doped materials; this decrease was related to the decreased oxygen stoichiometry at these temperatures. In Sr doped compositions, oxygen flux increased with increasing Sr content. Calculated values of ionic conductivity were greater than the conductivity of yttria stabilized zirconia. Substitution of Ca for Sr resulted in substantially lower fluxes.

23896 (PNL-SA–26451) **In situ MeV ion beam analysis of ceramic surfaces modified by 100-400 keV ion irradiation.** Weber, W.J. (Pacific Northwest Lab., Richland, WA (United States)); Yu, N.; Sickafus, K.E. Pacific Northwest Lab., Richland, WA (United States). May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9505122–2: International conference on ion beam analysis, Tempe, AZ (United States), 22-26 May 1995). Order Number DE95014623. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes use of the in situ ion beam analysis facility developed at Los Alamos National Laboratory for the study of irradiation effects in ceramic materials. In this facility, an analytical beamline of 3 MV tandem accelerator and an irradiation bean-dine of 200 kV ion implanter are connected at 60° to a common target chamber. This facility provides a fast, efficient, and quantitative measurement tool to monitor changes of composition and crystallinity of materials irradiated by 100-400 keV ions, through sequential measurement of backscattering events of MeV ions combined with ion channeling techniques. We will describe the details of the in situ ion beam analysis and ion irradiation and discuss some of the important issues and their solutions associated with the in situ experiment. These issues include (1) the selection of axial ion channeling direction for the measurement of radiation damage; (2) surface charging and charge collection for data acquisition; (3) surface sputtering during ion irradiation; (4) the effects of MeV analytical beam on the materials; and (5) the sample heating effect on ion beam analysis.

23897 (UCRL-JC–120259) **Resonant soft x-ray fluorescence studies of novel materials.** Carlisle, J.A. (Lawrence Livermore National Lab., CA (United States)); Terminello, L.J.; Hudson, E.A.; Shirley, E.L.; Jia, J.J.; Callcott, T.A.; Himpsel, F.J.; Ederer, D.L. Lawrence Livermore National Lab., CA (United States); Oak Ridge National Lab., TN (United States); Lawrence Berkeley Lab., CA (United States). 8 Feb 1995. 8p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Science Alliance Center of Excellence (United States). DOE Contract W-7405-ENG-48 ; AC05-84OR21400 ; AC03-76SF00098. Grant DMR-9017996; Grant DMR-9017997. (CONF-941144–161: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95013462. Source: OSTI; NTIS; INIS; GPO Dep.

The authors are using resonant soft x-ray fluorescence at the Advanced Light Source to probe the electronic and geometric structure of novel materials. In the resonant process, a core electron is excited by a photon whose energy is near the core binding energy. In this energy regime the absorption and emission processes are coupled, and this coupling manifests itself in several ways. In boron nitride (BN), the resonant emission spectra reflect the influence of a "spectator" electron in an unoccupied excitonic state. The resonant emission can be used to distinguish between the various bulk phases of BN, and can also be used to probe the electronic structure of a monolayer of BN buried in a bulk environment, where it is inaccessible to electron spectroscopies. For highly-oriented pyrolytic graphite (HOPG) a coherent absorption-emission process takes place in the resonant regime, whereby crystalline momentum is conserved between the core excited electron and the valence hole which remains after emission.

3606 Other Materials

Refer also to citation(s) 23165, 23473, 23476, 23477, 23540, 23743, 23755, 23830, 23842, 23861, 23867, 23873, 23897, 23965, 23967, 23996, 24020, 24026, 24035, 24036, 24046, 24912, 24919, 24920

23898 (ANL/CHM/CP–86590) **High resolution transmission electron microscopy study of diamond films grown from fullerene precursors.** Luo, J.S. (and others); Gruen, D.M.; Krauss,

A.R. Argonne National Lab., IL (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950518–12: 187. meeting of the Electrochemical Society, Reno, NV (United States), 21-26 May 1995). Order Number DE95013772. Source: OSTI; NTIS; GPO Dep.

High-resolution transmission electron microscopy (HRTEM) has been used to investigate the microstructure of diamond films grown by plasma-assisted chemical vapor deposition using fullerene precursors. HRTEM observations of as-grown films revealed an array of larger crystals (>200 nm) within a polycrystalline matrix of much smaller crystallites (<20 nm). The randomly oriented small crystallites were nearly free of structural imperfections such as stacking faults or twins, while the larger ones had preferred <110> orientations with respect to the Si (100) substrate and showed evidence of structural defects on the periphery of the crystals. The most common defects were V-shaped Σ9 twin boundaries, which are generally believed to serve as re-entrant sites for diamond nucleation and growth. The observation of growth steps on both (111) and (110) surfaces seems to support a reaction model in which fragments of C_{60}, including C_2, are considered the growth species. In particular, the nanocrystallinity of the films is most likely due to a high carbon cluster density from C_{60} fragmentation at or near the diamond surface, which can serve as nucleation sites for the growth of new crystallites.

23899 (ANL/CMT/CP–84525) **Performance testing of West Valley Reference 6 glass.** Ebert, W.L. (Argonne National Lab., IL (United States). Chemical Technology Div.); Bates, J.K. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950570–26: International high-level radioactive waste management conference: progress toward understanding, Las Vegas, NV (United States), 1-5 May 1995). Order Number DE95013442. Source: OSTI; NTIS; INIS; GPO Dep.

The chemical durability of West Valley Reference 6 glass is being evaluated by using a suite of laboratory tests which highlight the early, interim, and long-term stages of corrosion. The test results are being used to describe the glass corrosion path and its long-term durability. The long-term durability of the SRL Environmental Assessment glass is being evaluated for comparison. Test results also provide parameter values for an analytical corrosion model that can be used in performance assessments of specific disposal sites.

23900 (ANL/CMT/CP–84719) **The corrosion behavior of DWPF glasses.** Ebert, W.L. (Argonne National Lab., IL (United States). Chemical Technology Div.); Bates, J.K. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950401–6: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95013466. Source: OSTI; NTIS; INIS; GPO Dep.

The authors analyzed the corroded surfaces of reference glasses developed for the Defense Waste Processing Facility (DWPF) to characterize their corrosion behavior. The corrosion mechanism of nuclear waste glasses must be known in order to provide source terms describing radionuclide release for performance assessment calculations. Different DWPF reference glasses were corroded under conditions that highlighted various aspects of the corrosion process and led to different extents of corrosion. The glasses corroded by similar mechanisms, and a phenomenological description of their corrosion behavior is presented here. The initial leaching of soluble glass components results in the formation of an amorphous gel layer on the glass surface. The gel layer is a transient phase that transforms into a layer of clay crystallites, which equilibrates with the solution as corrosion continues. The clay layer does not act as a barrier to either water penetration or glass dissolution, which continues beneath it, and may eventually separate from the glass. Solubility limits for glass components may be established by the eventual precipitation of secondary phases; thus, corrosion of the glass becomes controlled by the chemical equilibrium between the solution and the assemblage of secondary phases. In effect, the solution is an intermediate phase through which the glass transforms to an energetically more favorable assemblage of phases. Implications regarding the prediction of long-term glass corrosion behavior are discussed.

23901 (ANL/CMT/CP–84722) **Laboratory testing of LITCO glasses.** Ellison, A. (Argonne National Lab., IL (United States). Chemical Technology Div.); Wolf, S.; Buck, E.; Luo, J.S.; Dietz, N.; Bates, J.K.; Ebert, W.L. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950401–7: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95013465. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this program is to measure, the intermediate and long-term durability of glasses developed by Lockheed Idaho Technology Co. (LITCO) for the immobilization of calcined radioactive wastes. The objective is to use accelerated corrosion tests as an aid in developing durable waste form compositions. This is a report of tests performed on two LITCO glass compositions, Formula 127 and Formula 532. The main avenue for release of radionuclides into the environment in a geologic repository is the reaction of a waste glass with ground water, which alters the glass and releases its components into solution. These stages in glass corrosion are analyzed by using accelerated laboratory tests in which the ratio of sample surface area to solution volume, SA/V, is varied. At low SA/V, the solution concentrations of glass corrosion products remain low and the reaction approaches the forward rate. At higher SA/V the solution approaches saturation levels for glass corrosion products. At very high SA/V the solution is rapidly saturated in glass corrosion products and secondary crystalline phases precipitate. Tests at very high SA/V provide information about the composition of the solution at saturation or, when no solution is recovered, the identities and the order of appearance of secondary crystalline phases. Tests were applied to Formula 127 and Formula 532 glasses to provide information about the interim and long-term stages in glass corrosion.

23902 (ANL/MSD/CP–86064) **Simulation of ionic surfaces from an absolutely convergent solution of the Madelung problem.** Wolf, D. Argonne National Lab., IL (United States). Apr 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9502105–1: International workshop on computer simulation in condensed matter physics, Athens, GA (United States), 20-24 Feb 1995). Order Number DE95013389. Source: OSTI; NTIS; GPO Dep.

The classic Madelung problem is cast into an absolutely convergent form that is readily evaluated by direct lattice summation, revealing a net r^{-5} range of the net Coulomb potential in ionic crystals and liquids. The realization that Coulomb interactions in condensed systems can actually be rather short ranged (provided the system is overall neutral) leads to the prediction, verified by computer simulations for rocksalt-structure surfaces, that all surfaces in predominantly ionic crystals should be fundamentally reconstructed. The work also provides a conceptual framework for the theoretical treatment of polar surfaces, as demonstrated for the case of the (111) surfaces of NaCl and MgO.

23903 (CONF-9410244–2) **Characterization of residual stresses in graded ceramic-metal structures: A comparison of diffraction experiments and FEM calculations.** Rabin, B.H. (Idaho National Engineering Lab., Idaho Falls, ID (United States)); Williamson, R.L.; Watkins, T.R.; Wang, X.L.; Hubbard, C.R.; Spooner, S. Oak Ridge National Lab., TN (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 3. international symposium on structural and functional gradient materials; Lausanne (Switzerland); 10-12 Oct 1994. Order Number DE95013225. Source: OSTI; NTIS; GPO Dep.

Numerical models have been extensively developed for predicting the thermomechanical behavior of ceramic-metal joints containing graded interlayers. The goal of such modeling is to be able to design optimum interlayer microstructural characteristics required to meet the needs of specific application conditions, and to use this design information to guide component fabrication. The graded specimen examined in this research was fabricated by powder processing methods. Al_2O_3-Ni was selected as a model system. The residual stresses expected in the specimen were predicted by FEM

calculations using an elastic-plastic model. Strain and stress distributions in the specimen were characterized experimentally using x-ray and neutron diffraction techniques. Preliminary neutron and x-ray diffraction measurements were not in very good agreement with FEM model predictions, particularly regarding the in-plane stresses along the axis of symmetry. These results suggest additional diffraction measurements on graded specimens having fewer interlayers should be carried out, and experimental verification of the constitutive assumptions used in the FEM model is needed.

23904 (CONF-950245–3) **Ceramic composites with a ductile Ni_3Al binder phase.** Tiegs, T.N.; Alexander, K.B.; Plucknett, K.P.; Menchhofer, P.A.; Becher, P.F.; Waters, S.B. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. international conference on the science of hard materials; Maui, HI (United States); 20-24 Feb 1995. Order Number DE95013352. Source: OSTI; NTIS; GPO Dep.

Composites using B-doped ductile Ni_3Al alloys were produced with both non-oxide (WC, TiC) and oxide (Al_2O_3) ceramic powders. Typical powder processing techniques were used to fabricate materials with ceramic contents from 0-95 vol. %. The microstructural morphology of the composites depends primarily on the wetting behavior between the alloys and the ceramic powders. The non-oxide ceramic powders wet well and the Ni_3Al alloys form a semi-continuous intergranular phase. On the other hand, the Ni_3Al alloys do not wet the oxide powders well and tend to form discrete "islands" of the metallic phase. Wetting in these materials can be improved by the addition of non-oxide particles, such as TiC. Results on the mechanical properties showed ambient temperature flexural strength similar to other Ni-based hardmetals. In contrast to the WC-Co materials, the flexural strength is retained to temperatures of at least 800 C. The fracture toughness and hardness were found to be equal or higher than comparable Co-based hardmetal systems. Initial corrosion tests showed excellent resistance to acid solutions.

23905 (CONF-9503144–2) **Investigation of optical loss mechanisms in oxide thin films.** Chow, A.F. (North Carolina State Univ., Raleigh, NC (United States)); Kingon, A.I.; Auciello, O.; Poker, D.B. Oak Ridge National Lab., TN (United States). May 1995. 12p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. international symposium on integrated ferroelectrics; Colorado Springs, CO (United States); 20-22 Mar 1995. Order Number DE95014270. Source: OSTI; NTIS; GPO Dep.

$KNbO_3$, $K(Ta,Nb)O_3$, $KTaO_3$, and Ta_2O_5 thin films have been grown by ion-beam sputter deposition. $KNbO_3$ has excellent nonlinear properties for second harmonic generation; however, high optical losses are still characteristic of these films. Several loss mechanisms, such as, high angle grain boundaries, twin domains, interface and surface scattering, and oxygen vacancies can all contribute to the high losses. In order to isolate the various mechanisms, amorphous Ta_2O_5 films, epitaxial cubic $KTaO_3$ and tetragonal $K(Ta,Nb)O_3$ films were grown on MgO and Al_2O_3 substrates subjected to post-deposition annealing treatments and various oxygen pressure conditions. The optical losses and refractive indices were observed to differ depending on the substrate surface and annealing treatments. Resonant scattering experiments were performed to analyze the oxygen composition. The optical properties of these oxide thin film systems are reported and the breakdown of the loss mechanisms is addressed.

23906 (CONF-950412–16) **Nanoindentation and nanoscratching of hard carbon coatings for magnetic disks.** Tsui, T.Y. (Rice Univ., Houston, TX (United States). Dept. of Materials Science); Pharr, G.M.; Oliver, W.C.; Bhatia, C.S.; White, R.L.; Anders, S.; Anders, A.; Brown, I.G. Oak Ridge National Lab., TN (United States); Oak Ridge Associated Universities, Inc., TN (United States); Lawrence Berkeley Lab., CA (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States);Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC05-84OR21400 ; AC05-76OR00033 ; AC03-76SF00098. From Spring meeting of the Materials Research Society (MRS); San Francisco, CA (United States); 17-21 Apr 1995. Order Number DE95013211. Source: OSTI; NTIS; GPO Dep.

Nanoindentation and nanoscratching experiments have been performed to assess the mechanical properties of several carbon thin films with potential application as wear resistant coatings for magnetic disks. These include three hydrogenated-carbon films prepared by sputter deposition in a H_2/Ar gas mixture (hydrogen contents of 20, 34, and 40 atomic %) and a pure carbon film prepared by cathodic-arc plasma techniques. Each film was deposited on a silicon substrate to thickness of about 300 run. The hardness and elastic modulus were measured using nanoindentation methods, and ultra-low load scratch tests were used to assess the scratch resistance of the films and measure friction coefficients. Results show that the hardness, elastic modulus, and scratch resistance of the 20 and 34% hydrogenated films are significantly greater than the 40% film, thereby showing that there is a limit to the amount of hydrogen producing beneficial effects. The cathodic-arc film, with a hardness of greater than 59 GPa, is considerably harder than any of the hydrogenated films and has a superior scratch resistance.

23907 (CONF-950412–21) **Amorphous diamond-like carbon film growth by KrF- and ArF- excimer laser PLD: Correlation with plume properties.** Puretzky, A.A. (Institute of Spectroscopy, Troitsk (Russian Federation)); Geohegan, D.B.; Jellison, G.E. Jr. Oak Ridge National Lab., TN (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Spring meeting of the Materials Research Society (MRS); San Francisco, CA (United States); 17-21 Apr 1995. Order Number DE95013987. Source: OSTI; NTIS; GPO Dep.

A comparative study of ArF- and KrF-laser deposition of amorphous diamond-like carbon (DLC) films and relevant carbon plasmas has been performed. Spectroscopic ellipsometry and EELS analysis of the DLC films deposited on Si <100> and NaCl substrates were utilized to characterize the high quality ArF- and KrF-laser deposited films (up to 84% of sp^3 bonded carbon in 7 J/cm^2 -ArF-laser DLC film). Gated ICCD imaging, luminescence and ion current probe diagnostics of the carbon plume have revealed quite different properties of carbon plasmas generated by ArF- and KrF- lasers. KrF-laser (6.7 J/cm^2) irradiation produces a less energetic carbon plasma containing larger amounts of C_2 and probably larger clusters compared with ArF-laser irradiation at the same energy fluence. We conclude that the more energetic and highly-atomized ArF-laser carbon plasma results in the better diamond-like properties.

23908 (DOE/ER/13662–T3) **Energy changes in transforming solids. Final report, January 31, 1991–January 31, 1995.** Herrmann, G.; Barnett, D.M. Stanford Univ., CA (United States). 3 Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-87ER13662. Order Number DE95012448. Source: OSTI; NTIS; GPO Dep.

The following topics are discussed: A new thermodynamical theory of continuum damage mechanics capable of incorporating non-isothermal processes and of providing explicit expressions for the thermal dissipation during damage evolution; the advancement of the methodology of heterogenization to analyze elastic bodies with defects; and investigations of bonded dissimilar piezoelectric half-spaces.

23909 (DOE/ER/45278–T3) **Defect studies in thin film III-V thin film semiconductors. Progress report, September 1986–May 1987.** Ast, D.G. Cornell Univ., Ithaca, NY (United States). Dept. of Materials Science and Engineering. May 1987. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER45278. Order Number DE95013306. Source: OSTI; NTIS; GPO Dep.

Progress is reported on the following: defect formation at the InGaAs/GaAs interface as a function of the misfit parameter, layer thickness, and starting substrate dislocation density; and epitaxial growth on very small islands to verify theoretical predictions of critical layer thickness as a function of area.

23910 (DOE/ER/45278–T4) **Nucleation, propagation, electronic levels and elimination of misfit dislocations in III-V**

semiconductor interfaces. Final report, September 1, 1986–August 31, 1993. Ast, D.G.; Watson, G.P.; Matragrano, M. Cornell Univ., Ithaca, NY (United States). Mar 1995. 292p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER45278. Order Number DE95013305. Source: OSTI; NTIS; GPO Dep.

Misfit dislocations in gallium arsenides, indium arsenides, and zinc selenides are discussed. The growth of strained epitaxial layers, isolation and nucleation, thermal stability, and electronic and structural characteristics of misfit dislocations are described.

23911 (DOE/ID/13236–T1) **Development of lead-free copper alloy-graphite castings. Technical report, January 1994–December 1994.** Rohatgi, P.K. Wisconsin Univ., Milwaukee, WI (United States). [1995]. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-93ID13236. Order Number DE95015157. Source: OSTI; NTIS; GPO Dep.

Water model experiments were conducted to develop a two-stage stirring method for obtaining higher yields and a more uniform distribution of graphite particles in copper alloys. This was followed by several melts for synthesis of copper-graphite alloys in which Ti was used as a wetting agent to improve the wettability of graphite in the copper melt. In the first stage, a vortex method was employed to facilitate the addition of graphite particles into the copper melt. In the second stage, a specially designed stirrer was used for uniform particle distribution while avoiding the formation of vortex in the melt. The two-stage stirring was found to considerably improve the recovery of graphite, over those obtained with the prior practice of single-stage stirring and resulting in a more uniform particle distribution. In addition, graphite recoveries increased with increasing Ti content in the range investigated. Floatation, fluidity, and directional solidification experiments were also conducted on copper-graphite alloys synthesized in this study. Fluidity tests showed that the spiral fluidity length of the yellow brass alloy increased with temperature and decreased with graphite. The fluidity of copper-graphite alloys investigated to-date remained adequate to make a variety of castings. The observations of casting microstructure under directional solidification and floatation showed that in certain castings the graphite particles remained agglomerated, and they readily floated to the upper part of the castings where they reduced the size of gains. However, even in the agglomerated form, the graphite particles improved the machinability of copper alloys in a manner similar to lead. The results of the first year work provide an improved method of synthesis of lead free copper graphite alloys with improved machinability and adequate fluidity.

23912 (DOE/PC/94222–2) **Tunable composite membranes for gas separations. Progress report, January 1995–April 1995.** Ferraris, J.P.; Balkus, K.J. Jr.; Musselman, I.H. Texas Univ., Richardson, TX (United States). Dept. of Chemistry. Apr 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-94PC94222. Order Number DE95015603. Source: OSTI; NTIS; GPO Dep.

Research continued on membrane technology. This period, progress is reported on polymer (thiophenes) synthesis and construction of a computer controlled permeameter.

23913 (DOE/SF/19888–T1) **Lighting research - porous silicon phosphors. Final technical report.** Solanki, R. Oregon Graduate Inst. of Science and Technology, Portland, OR (United States). Dept. of Electrical Engineering and Applied Physics. [1995]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-93SF19888. Order Number DE95015115. Source: OSTI; NTIS; GPO Dep.

The objective of this project was to investigate the use of porous silicon as a possible efficient phosphor for lighting applications. The preparation, by means of electroetching, is described.

23914 (JAERI-Tech–95-007) **Radiation effects on carbon fiber-reinforced plastics for spacecraft materials.** Udagawa, Akira (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research Establishment); Kudoh, Hisaaki; Sasuga, Tsuneo; Morino, Yoshiki; Seguchi, Tadao; Yudate, Kozo. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 31p. (In Japanese). Order Number DE95789253. Source: OSTI; NTIS; INIS.

The effects of space environment were studied for two kinds of carbon fiber-reinforced plastics(CFRP) which were an epoxy resin composite using construction materials of satellite and a polyimide(PMR-15) composite expecting bright future space materials for long term operation. Resistibility of these materials to the space environments were evaluated from the change of mechanical properties after exposure of electron, proton, atomic oxygen and thermal cycling. It was found that the CFRP with PMR-15 as a matrix had good performance in the space environments. No differences in the mechanical properties for the materials were observed between proton and electron irradiations. (author).

23915 (LA-UR–95-1245) **Preparation of diamond-like carbon and boron nitride films by high-intensity pulsed ion beam deposition.** Rej, D.J. (Los Alamos National Lab., NM (United States)); Davis, H.A.; Remnev, G.E. Los Alamos National Lab., NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950840–2: International conference on applications of diamond films and related materials, Gaithersburg, MD (United States), 21-24 Aug 1995). Order Number DE95012076. Source: OSTI; NTIS; GPO Dep.

Intense ion beams (300-keV C^+, O^+, and H^+, 20–30 kA, 50 to 400-ns pulsewidth, up to 0.3-Hz repetition rate) were used to prepare diamond-like carbon (DLC) and boron nitride (BN) films. Deposition rates of up to 25±5 nm/pulse were obtained with instantaneous rates exceeding 1 mm/s. Most films were uniform, light brown, translucent, and nonporous with some micron-size particulates. Raman and parallel electron energy loss spectroscopy indicated the presence of DLC. The films possessed favorable electron field-emission characteristics desirable for cold-cathode displays. Transmission electron microscopy (TEM) and transmission electron diffraction (TED) revealed that the C films contained diamond crystals with 25 to 125-nm grain size. BN films were composed of hexagonal, cubic and wurtzite phases.

23916 (LA-UR–95-1463) **Characterization of three dimensional fiber orientation in short-fiber composites.** Zhu, Yuntian T.; Blumenthal, W.R. Los Alamos National Lab., NM (United States). [1995]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-951026–1: Fall meeting of the Minerals, Metals and Materials Society: physical metallurgy and materials, Cleveland, OH (United States), 29 Oct - 2 nov 1995). Order Number DE95010986. Source: OSTI; NTIS; GPO Dep.

A mathematical procedure for recovering from image analysis the three dimensional nonsymmetric fiber-orientation distribution in short-fiber composites is proposed. Microphotographs from two orthogonal faces of a composite sample are needed to determine the three dimensional fiber orientation. A simple weighting function is derived to take into account the probability of intercepting fibers at varying inclination angles. The present procedure improves the previous works of other researchers in the following two aspects. First, it can obtain the single-angle fiber-orientation distribution from one micrograph in reference to the normal of the photographed surface. This distribution is often needed in predicting the mechanical and physical properties of short-fiber composites in this direction. Second, no symmetry in fiber-orientation distribution is assumed in the determination of the three dimensional fiber-orientation, which makes the present procedure more practical and versatile.

23917 (LA-UR–95-1464) **Direct fiber strengthening in three dimensional random-oriented short-fiber composites.** Zhu, Y.T.; Blumenthal, W.R. Los Alamos National Lab., NM (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-951026–3: Fall meeting of the Minerals, Metals and Materials Society: physical metallurgy and materials, Cleveland, OH (United States), 29 Oct - 2 nov 1995). Order Number DE95011998. Source: OSTI; NTIS; GPO Dep.

A theory for direct fiber strengthening in random-oriented short-fiber composites is developed. It adopts a maximum load composite failure criterion and takes into account the fiber orientation effect on the probability of a fiber being intercepted by a specimen cross-section. The strain and load of short fibers with different inclination angles with respect to the loading direction were

first calculated, and their contribution in carrying load toward the composite load direction was integrated to give the total load. The fibers with smaller inclination angles bear greater stress and break first. This load is then transferred to fibers with larger inclination angles. Direct fiber strengthening component of the composite strength was calculated from the maximum total load these short fibers can carry. The present theory predicts a much greater direct short-fiber strengthening than does previous theories, and provides useful information for composite design and strength assessment.

23918 (LA-UR–95-1520) **Characterizing size dependence of ceramic-fiber strength using modified Weibull distribution.** Zhu, Yuntian; Blumenthal, W.R. Los Alamos National Lab., NM (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-951026–2: Fall meeting of the Minerals, Metals and Materials Society: physical metallurgy and materials, Cleveland, OH (United States), 29 Oct - 2 nov 1995). Order Number DE95011985. Source: OSTI; NTIS; GPO Dep.

The strengths of ceramic fibers have been observed to increase with decreasing fiber diameter and length. The traditional single-modal Weibull distribution function can only take into account one type of flaw, which makes it inappropriate to characterize the strength dependence of both the diameter and the length since ceramic fibers usually have both volume and surface flaws which affect the strength dependence in different ways. Although the bi-modal Weibull distribution can be used to characterize both volume and surface flaws, the mathematical difficulty in its application makes it undesirable. In this paper, the factors affecting fiber strength are analyzed in terms of fracture mechanics and flaw formation. A modified Weibull distribution function is proposed to characterize both the diameter dependence and the length dependence of ceramic fibers.

23919 (LBL–37379) **The picosecond dynamics of electron-hole pairs in graded and homogeneous CdS_xSe_{1-x} semiconductors.** Hane, J.K. Lawrence Livermore National Lab., CA (United States). May 1995. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95016457. Source: OSTI; NTIS; GPO Dep.

Wavelength and composition dependence of the time-resolved luminescence were examined. Effects of macroscopic composition gradient and microscopic alloy disorder on e^--h^+ pair dynamics were probed. Materials with both increasing and decreasing S content with distance from the surface were examined, where $0 \leq x \leq 1$ over the full range. In these graded materials, the band gap energy also varies with position. The graded semiconductor luminescence shows strong wavelength dependence, showing diffusion in both band gap and concentration gradients. A bottleneck in the diffusion is attributed to localization occurring primarily in the materials with greatest alloy disorder, i.e. around $CdS_{0.5}Se_{0.50}$. Homogeneous materials were studied for x = 0, 0.25, 0.50, 0.75, 1; the time-resolved luminescence depends strongly on the composition. The mixed compositions have longer decay constants than CdS and CdSe. Observed lifetimes agree with a picture of localized states induced by the alloy disorder. For a given homogeneous crystal, no wavelength dependence of the time decays was observed. Picosecond luminescence upconversion spectroscopy was used to study further the dependence of the luminescence on composition. Large nonexponential character in the decay functions was observed in the alloys; this long time tail can be attributed to a broad distribution of relaxation times as modeled by the Kohlrausch exponential.

23920 (LBL-PUB–754, pp. 13-18) **A study of the suitability of ferrite for use in low-field insertion devices.** Johnson, K.; Hassenzahl, W.V. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

Most insertion devices built to date use rare-earth permanent-magnet materials, which have a high remanent field and are more expensive than many other permanent-magnet materials. Low-field insertion devices could use less-expensive, lower performance magnetic materials if they had suitable magnetic characteristics. These materials must be resistant to demagnetization during construction and operation of the insertion device, have uniform magnetization, possess low minor-axis magnetic moments, and have small minor field components on the surfaces. This paper describes an investigation to determine if ferrite possesses magnetic qualities suitable for insertion device applications. The type of ferrite investigated, MMPA Ceramic 8 from Stackpole Inc., was found to be acceptable for insertion device applications.

23921 (PNL–10562) **Accelerated aging studies and environmental stability of prototype tamper tapes.** Wright, B.W. (Pacific Northwest Lab., Richland, WA (United States)); Wright, C.W.; Bunk, A.R. Pacific Northwest Lab., Richland, WA (United States). May 1995. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012941. Source: OSTI; NTIS; GPO Dep.

This report describes the results of accelerated aging experiments (weathering) conducted on prototype tamper tapes bonded to a variety of surface materials. The prototype tamper tapes were based on the patented Confirm® tamper-indicating technology developed and produced by 3M Company. Tamper tapes bonded to surfaces using pressure sensitive adhesive (PSA) and four rapid-set adhesives were evaluated. The configurations of the PSA-bonded tamper tapes were 1.27-cm-wide Confirm® 1700 windows with vinyl underlay and 2.54-cm-wide Confirm® 1700 windows with vinyl and polyester underlays. The configurations of the rapid-set adhesive-bonded tamper tapes were 2.54-cm-wide Confirm® (1700, 1500 with and without primer, and 1300) windows with vinyl underlay. Surfaces used for bonding included aluminum, steel, stainless steel, Kevlar®, brass, copper, fiberglass/resin with and without gel coat, polyurethane-painted steel, acrylonitrile:butadiene:styrene plastic, polyester fiberglass board, Lexan polycarbonate, and cedar wood. Weathering conditions included a QUV cabinet (ultraviolet light at 60°C, condensing humidity at 40°C), a thermal cycling cabinet (-18°C to 46°C), a Weather-O-Meter (Xenon lamp), and exposure outdoors in Daytona Beach, Florida. Environmental aging exposures lasted from 7 weeks to 5 months. After exposure, the tamper tapes were visually examined and tested for transfer resistance. Tamper tapes were also exposed to a variety of chemical liquids (including organic solvents, acids, bases, and oxidizing liquids) to determine chemical resistance and to sand to determine abrasion resistance.

23922 (SAND–94-0340) **Electrophoretically-deposited solid film lubricants.** Dugger, M.T.; Panitz, J.K.J.; Vanecek, C.W. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013556. Source: OSTI; NTIS; GPO Dep.

An aqueous-based process that uses electrophoresis to attract powdered lubricant in suspension to a charged target was developed. The deposition process yields coatings with low friction, complies with environmental safety regulations, requires minimal equipment, and has several advantages over processes involving organic binders or vacuum techniques. This work focuses on development of the deposition process, includes an analysis of the friction coefficient of the material in sliding contact with stainless steel under a range of conditions, and a functional evaluation of coating performance in a precision mechanical device application. Results show that solid lubricant films with friction coefficients as low as 0.03 can be produced. A 0.03 friction coefficient is superior to solid lubricants with binder systems and is comparable to friction coefficients generated with more costly vacuum techniques.

23923 (SAND–94-3244C) **High rate ECR etching of III-V nitride materials.** Shul, R.J. (Sandia National Labs., Albuquerque, NM (United States)); Howard, A.J.; Kilcoyne, S.P.; Pearton, S.J.; Abernathy, C.R.; Vartuli, C.B.; Barnes, P.A.; Bozack, M.J. Sandia National Labs., Albuquerque, NM (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950518–6: 187. meeting of the Electrochemical Society, Reno, NV (United States), 21-26 May 1995). Order Number DE95013032. Source: OSTI; NTIS; GPO Dep.

The III-V nitride compound semiconductors are attracting considerable attention for blue and ultraviolet light emitting diodes (LEDs)

and lasers as well as high temperature electronics due to their wide band gaps and high dielectric constants. The recent progress observed in the growth of these materials has not been matched by progress in processing techniques to fabricate more highly sophisticated devices. Patterning these materials has been especially difficult due to the relatively inert chemical nature of the group-III nitrides. The authors review dry etch techniques which have been used to pattern these materials including electron cyclotron resonance (ECR), reactive ion etch (RIE), and chemically assisted ion beam etching (CAIBE). ECR etch rates greater than 3,800 Å/min for InN, 3,500 Å/min for GaN, and 1,170 A/min for AlN are reported. Etch anisotropy, surface morphology, and near-surface stoichiometry will be discussed.

23924 (SAND–95-0833C) **Damage evolution in metal matrix composites subjected to thermomechanical fatigue.** Allen, D.H. (Texas A and M Univ., College Station, TX (United States). Center for Mechanics of Composites); Hurtado, L.D.; Helms, K.L.E. Sandia National Labs., Albuquerque, NM (United States). [1995]. 4p. Sponsored by Department of the Air Force, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505115–4: ASCE engineering mechanics conference, Boulder, CO (United States), 21-24 May 1995). Order Number DE95011896. Source: OSTI; NTIS; GPO Dep.

A thermomechanical analysis of unidirectional continuous fiber metal matrix composites is presented. The analysis includes the effects of processing induced residual thermal stresses, interface cracking, and inelastic matrix behavior on damage evolution. Due to the complexity of the nonlinear effects, the analysis is performed computationally using the finite element method. The interface fracture is modeled by a nonlinear constitutive model. The problem formulation is summarized and results are presented for a four-ply unidirectional SCS-6/β21S titanium composite under high temperature isothermal mechanical fatigue.

23925 (SAND–95-0869C) **Yield strength and stress relaxation data for an adhesive used in butt joint tests.** Guess, T.R.; Reedy, E.D. Jr. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951033–1: 27. international technical conference of the Society for the Advancement of Material and Process Engineering: diversity into the next century, Albuquerque, NM (United States), 9-12 Oct 1995). Order Number DE95013866. Source: OSTI; NTIS; GPO Dep.

Mechanical property data are reported for Epon 828/T403, an amine-cured epoxy adhesive. Data include compression modulus, compression yield strength and compression stress relaxation as a function of stress level, strain rate, and temperature and Mode I fracture toughness as a function of temperature. This data was generated to support a study investigating how temperature effects joint strength and the corresponding interface corner fracture toughness for adhesively bonded butt joints.

23926 (SAND–95-0933C) **Bridged polysilsesquioxane xerogels: A molecular based approach for the preparation of porous hybrid organic-inorganic materials.** Small, J.H. (Univ. of California, Irvine, CA (United States). Dept. of Chemistry); Shea, K.J.; Loy, D.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 3p. Sponsored by National Science Foundation, Washington, DC (United States);Department of the Air Force, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950801–2: 210. national meeting of the American Chemical Society, Chicago, IL (United States), 20-25 Aug 1995). Order Number DE95012226. Source: OSTI; NTIS; GPO Dep.

Bridged polysilsesquioxanes represent an interesting family of hybrid organic-inorganic composite materials. It has been shown that manipulation of the organic bridging component offers the potential for the synthesis of a variety of materials with a range of surface areas and porosities. In addition, incorporation of a heteroatom within the bridging organic component allows for further chemical transformation of the polysilsesquioxane material.

23927 (SAND–95-1290C) **Diffusion in polycrystalline microstructures.** Swiler, T.P.; Holm, E.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950401–12: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95014217. Source: OSTI; NTIS; GPO Dep.

Mass transport properties are important in polycrystalline materials used as protective films. Traditionally, such properties have been studied by examining model polycrystalline structures, such as a regular array of straight grain boundaries. However, these models do not account for a number of features of real grain ensembles, including the grain size distribution and the topological aspects of grain boundaries. In this study, a finite difference scheme is developed to study transient and steady-state mass transport through realistic two-dimensional polycrystalline microstructures. Effects of microstructural parameters such as average grain size and grain boundary topology are examined, as are effects due to limits of the model.

23928 (SAND–95-1291C) **Semiempirical study of hydrogen addition to single-walled carbon nanotubes.** Cahill, P.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950518–14: 187. meeting of the Electrochemical Society, Reno, NV (United States), 21-26 May 1995). Order Number DE95014606. Source: OSTI; NTIS; GPO Dep.

Single-walled carbon nanotube models have been constructed by insertion of 10-carbon bracelets into C_{70} to form C_{80} and C_{120}. Semiempirical heats of vicinal hydrogenation along the sides of the tubes are ~40 kcal/mol more endothermic (less stable) than addition to the endcaps. Based on the similarity of the endcaps to C_{60}, hydrogenation of nanotubes is estimated to be approximately thermoneutral; therefore, only relatively high energy dienes or other species are likely to yield stable addended products.

23929 (SAND–95-1320) **Polyelectrolyte gels.** Segalman, D.J.; Witkowski, W.R. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015061. Source: OSTI; NTIS; GPO Dep.

Polyelectrolyte (PE) gels are swollen polymer/solvent networks that undergo a reversible volume collapse/expansion through various types of stimulation. Applications that could exploit this large deformation and solvent expulsion/absorption characteristics include robotic "fingers" and drug delivery systems. The goals of the research were to first explore the feasibility of using the PE gels as "smart materials" - materials whose response can be controlled by an external stimulus through a feedback mechanism. Then develop a predictive capability to simulate the dynamic behavior of these gels. This involved experimentally characterizing the response of well-characterized gels to an applied electric field and other stimuli to develop an understanding of the underlying mechanisms which cause the volume collapse. Lastly, the numerical analysis tool was used to simulate various potential engineering devices based on PE gels. This report discusses the pursuit of those goals through experimental and computational means.

23930 (UCRL-ID–119832) **Corrosion of candidate materials in Lake Rotokawa geothermal exposure.** Estill, J.C.; McCright, R.D. Lawrence Livermore National Lab., CA (United States). May 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015128. Source: OSTI; NTIS; GPO Dep.

Corrosion rates were determined for CDA 613, CDA 715, A-36 carbon steel, 1020 carbon steel, and Alloy 825 flat coupons which were exposed to geothermal spring water at Paraiki site number 9 near Lake Rotokawa, New Zealand. Qualitative observations of the corrosion performance of Type 304L stainless steel and CDA 102 exposed to the same environment were noted. CDA 715, Alloy 825, 1020 carbon steel, and other alloys are being considered for the materials of construction for high-level radioactive waste containers for the United States civilian radioactive waste disposal program. Alloys CDA 613 and CDA 102 were tested to provide copper-based materials for corrosion performance comparison purposes. A36 was tested to provide a carbon steel baseline material for comparison purposes, and alloy 304L stainless steel was tested

to provide an austenitic stainless steel baseline material for comparison purposes. In an effort to gather corrosion data from an environment that is rooted in natural sources of water and rock, samples of some of the proposed container materials were exposed to a geothermal spring environment. At the proposed site at Yucca Mountain, Nevada, currently under consideration for high-level nuclear waste disposal, transient groundwater may come in contact with waste containers over the course of a 10,000-year disposal period. The geothermal springs environment, while extremely more aggressive than the anticipated general environment at Yucca Mountain, Nevada, could have similarities to the environment that arises at selected local sites on a container as a result of crevice corrosion, pitting corrosion, microbiologically influenced corrosion (MIC), or the concentration of the ionic species due to repetitive evaporation or boiling of the groundwater near the containers. The corrosion rates were based on weight loss data obtained after six weeks exposure in a 90°C, low-pH spring with relatively high concentrations of SO_4^{2-} and Cl^-.

23931 (UCRL-ID–120162) **Enhancing tensile ductility of a particulate-reinforced aluminum MMC by lamination with Mg-9% Li alloy.** Syn, C.K. (Lawrence Livermore National Lab., CA (United States)); Lesuer, D.R.; Sherby, O.D. Lawrence Livermore National Lab., CA (United States). May 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013917. Source: OSTI; NTIS; GPO Dep.

A laminated metal composite has been made by press bonding alternating layers of a particulate-reinforced aluminum MMC, 6090/SiC/25p, and a Mg-9%Li alloy. The mechanical properties including tensile ductility were evaluated. The tensile ductility of the Al MMC was found to increase from 3.5% to 11.5%. In contrast to other laminates based on ultrahigh carbon, steel, the laminate of this study and other Al MMC laminates exhibited tensile yield strengths that did not follow the rule of averages. This is attributed to interlayer reaction products developed during processing of the Al MMC laminates.

23932 (UCRL-JC–118164) **Failure characterization of nodular defects in multi-layer dielectric coatings.** Sawicki, R.H.; Shang, C.C.; Swatloski, T.L. Lawrence Livermore National Lab., CA (United States). 20 Dec 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410155–4: 26. annual symposium on optical materials for high power lasers: Boulder damage symposium, Boulder, CO (United States), 24-26 Oct 1994). Order Number DE95014124. Source: OSTI; NTIS; INIS; GPO Dep.

Nodular defects in multi-layer dielectric coatings have been computer modeled to characterize the electro-mechanical responses to laser pulses with wavelengths of 1.06 μm and pulse lengths between 1 and 20 ns. The simulation begins with an axisymmetric electric field model using AMOS, a full-wave Maxwell solver with lossy (dispersive) electric and magnetic material models. Electric fields calculated by this code determine the spatial distribution of absorbed laser energy in the vicinity of the nodule. This data is linked to a thermal/stress model and mechanical calculations are executed using the general purpose finite element code COSMOS/M. The simulation estimates the transient temperature response of the nodule and the surrounding medium and predicts the dynamic stresses caused by the thermal impulse. This integrated computer process has been exercised to characterize failure of nodules as a function of defect characteristics, including seed size and depth.

23933 (UCRL-JC–118192) **Properties of transition metal-doped zinc chalcogenide crystals for tunable IR laser radiation.** DeLoach, L.D. (and others); Page, R.H.; Wilke, G.D. Lawrence Livermore National Lab., CA (United States). 17 Mar 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950101–5: Advanced solid-state laser conference, Memphis, TN (United States), 29 Jan - 1 feb 1995). Order Number DE95014370. Source: OSTI; NTIS; INIS; GPO Dep.

The spectroscopic properties of Cr^{2+}, Co^{2+}, and Ni^{2+}-doped single crystals of ZnS, ZnSe, and ZnTe have been investigated to understand their potential application as mid-IR tunable solid-state laser media. The spectroscopy indicated divalent Cr was the most favorable candidate for efficient room temperature lasing, and accordingly, a laser-pumped laser demonstration of Cr:ZnS and Cr:ZnSe has been performed. The lasers' output were peaked at ~ 2.35 μm and the highest measured slope efficiencies were ~ 20% in both cases.

23934 (UCRL-JC–118841) **Rapid growth of diamond-like-carbon films by copper vapor laser ablation.** McLean, W. (and others); Warner, B.E.; Havstad, M.A. Lawrence Livermore National Lab., CA (United States). Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950412–20: Spring meeting of the Materials Research Society (MRS), San Francisco, CA (United States), 17-21 Apr 1995). Order Number DE95014165. Source: OSTI; NTIS; INIS; GPO Dep.

Visible light from a copper vapor laser (CVL) operating with 510 and 578 nm radiation (intensity ratio approximately 2:1), an average power of 100 W, a pulse duration of 50 ns, and a repetition frequency of 4.4 kHz has been shown to produce high quality diamond-like-carbon (DLC) films at fluences between $2x10^8$ and $5x10^{10}$ W/cm^2. Maximum deposition rates of 2000 μm·cm^2/h were obtained at $5x10^8$ W/cm^2. DLC films with hardness values of approximately 60 GPa were characterized by a variety of techniques to confirm DLC character, hydrogen content, and surface morphology. The presence of C_2 in the vapor plume was confirmed by the presence of the C_2 Swan bands in emission spectra obtained during the process. Economic implications of process scale-up to industrially meaningful component sizes are presented.

23935 (UCRL-JC–119216) **Magnetic x-ray circular dichroism in nickel-gold multilayers.** Jankowski, A.F. (Lawrence Livermore National Lab., CA (United States)); Tobin, J.G.; Waddill, G.D. Lawrence Livermore National Lab., CA (United States). 11 Nov 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941144–160: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95013459. Source: OSTI; NTIS; GPO Dep.

Magnetic circular dichroism in x-ray absorption is used to investigate the in-plane, remnant magnetization of well-characterized $Ni_{0.48}/Au_{0.52}$ multilayers. Large superlattice strains are found in this multilayer system for samples with a 2nm layer pair spacing. A larger dichroism is found in the Ni 2p absorption edge for a 1.8 nm than for a 4.4 nm layer pair sample. The larger dichroism is consistent with a larger magnitude of in-plane strain for the Ni layers and a larger total magnetic anisotropy energy as previously shown from magnetization curves.

23936 (UCRL-JC–119571) **Molecular dynamics modeling of ultrathin amorphous carbon films.** Glosli, J.N. (Lawrence Livermore National Lab., CA (United States)); Belak, J.; Philpott, M.R. Lawrence Livermore National Lab., CA (United States). May 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9505192–3: 4. international symposium on diamond materials, Reno, NV (United States), 21-26 May 1995). Order Number DE95014454. Source: OSTI; NTIS; GPO Dep.

Amorphous carbon films about 20 mn thick are used by the computer industry as protective coatings on magnetic disks. The structure and function of this family of materials at the atomic level is poorly understood. The growth and properties of a:C and a:CH films 1 to 5 nm thick has been simulated using classical molecular dynamics and a bond-order potential with torsional terms. Studies of quenched melts that verify the ability of this potential to reproduce known features of extended structures of carbon in two and three dimensions are briefly described. In molecular dynamics calculations the incident species were neutral atoms C, or C and H with energies up to 100 eV. The stoichiometry, chemical bonding and distribution functions within the films were analyzed using IBM's Power Visualization System for different incident gas energies. Microscopic features such as multiple ring structures, including planar graphitic structures, were easily identified. Some preliminary studies of the nanotribology of the a:C films are described, including nano-indentation and sliding in contact with a rigid probe.

23937 (UCRL-LR–120950) **Analysis of compressive fracture in rock using statistical techniques.** Blair, S.C. Lawrence Livermore National Lab., CA (United States); California Univ., Berkeley, CA (United States). Dec 1994. 272p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014694. Source: OSTI; NTIS; GPO Dep.

Fracture of rock in compression is analyzed using a field-theory model, and the processes of crack coalescence and fracture formation and the effect of grain-scale heterogeneities on macroscopic behavior of rock are studied. The model is based on observations of fracture in laboratory compression tests, and incorporates assumptions developed using fracture mechanics analysis of rock fracture. The model represents grains as discrete sites, and uses superposition of continuum and crack-interaction stresses to create cracks at these sites. The sites are also used to introduce local heterogeneity. Clusters of cracked sites can be analyzed using percolation theory. Stress-strain curves for simulated uniaxial tests were analyzed by studying the location of cracked sites, and partitioning of strain energy for selected intervals. Results show that the model implicitly predicts both development of shear-type fracture surfaces and a strength-vs-size relation that are similar to those observed for real rocks. Results of a parameter-sensitivity analysis indicate that heterogeneity in the local stresses, attributed to the shape and loading of individual grains, has a first-order effect on strength, and that increasing local stress heterogeneity lowers compressive strength following an inverse power law. Peak strength decreased with increasing lattice size and decreasing mean site strength, and was independent of site-strength distribution. A model for rock fracture based on a nearest-neighbor algorithm for stress redistribution is also presented and used to simulate laboratory compression tests, with promising results.

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23938 (ANL/CHM/CP–85752) **Separation of americium from europium by solvent extraction from aqueous phosphonate media.** Ensor, D.D. (Tennessee Technological Univ., Cookeville, TN (United States). Dept. of Chemistry); Nash, K.L. Argonne National Lab., IL (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-940301–47: 207. spring national meeting of the American Chemical Society (ACS), San Diego, CA (United States), 13-18 Mar 1994). Order Number DE95012269. Source: OSTI; NTIS; GPO Dep.

Complexes between Am^{3+} or Eu^{3+} and phosphonoacetic acid differ in relative stability in accord with the electrostatic model of cation binding. The smaller Eu^{3+} cation forms stronger complexes with PAA than the larger Am^{3+} cation. The observed metal complexes in the acid range from 0.005 M to 0.02 M (at I= 0.5 M) are $Eu(HL)^{+}$, $Eu(H_2L)_2^{+}$, $Eu(HL)_2^{-}$ and $Am(H_2L)^{2+}$, $Am(HL)^{+}$, $Am(H_2L)_2^{+}$. When used as a holdback reagent, PAA slightly enhances the separation of Am/Eu when used with sulfonic acids or CMPO/nitrate, but reduces separation efficiency with HDEHP. In a $CMPO/SCN^{-}$ extraction system which favors extraction of Am over Eu, addition of PAA increases the separation efficiency by a factor of 2-3 at 0.3 M PAA/0.5 M SCN^{-}. The calculated stability constants can be used to explain the separation factors, but do not always accurately predict metal distribution ratios in the CMPO systems, implying that there are details of this system which have not been fully elucidated.

23939 (ANL/ET/CP–84607) **DSP-based on-line NMR spectroscopy using an anti-Hebbian learning algorithm.** Razazian, K. (Argonne National Lab., IL (United States). Energy Technology Div.); Dieckman, S.L.; Raptis, A.C.; Bobis, J.P. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9507134–1: IEEE Industrial Electronics Society conference, Athens (Greece), 10-14 Jul 1995). Order Number DE95014222. Source: OSTI; NTIS; GPO Dep.

This paper describes a nuclear magnetic resonance (NMR) system that uses an adaptive algorithm to carry out real-time NMR spectroscopy. The system employs a digital signal processor (DSP) chip to regulate the transmitted and received signal together with spectral analysis of the received signal to determine free induction decay (FID). To implement such a signal-processing routine for detection of the desired signal, an adaptive line enhancer filter that uses an anti-Hebbian learning algorithm is applied to the FID spectra. The results indicate that the adaptive filter can be a reliable technique for on-line spectroscopy study.

23940 (CIEMAT–760) **Analysis of sample composition using resonant ionization and time-of-flight techniques.** Luz, A. de la; Ortiz, M.; Campos, J. No corporate text available. 1995. 200p. (In Spanish). Order Number DE95780847. Source: OSTI; NTIS; INIS.

This paper describes the setting up of a linear time-of-flight mass spectrometer that uses a tunable laser to produce resonant ionization of atoms and molecules in a pulsed supersonic beam. The ability of this kind of systems to produce time resolved signals for each species present in the samples allows quantitative analysis of its composition. By using a tunable laser beam of high spectral resolution to produce ionization, studies based on the structure of the photoionization spectra obtained are possible. In the present work several isotopic species of ordinary and deuterated benzene have been studies. special care has been dedicated to the influence of the presence of a "13 C in the ring. In this way values for spectroscopic constants and isotopic shifts have been obtained. Another system based in a homemade proportional counter has been designed and used as an auxiliary system. The results obtained with it are independent of these mentioned above and compatible with them. This system is of great utility for laser wavelength tuning to produce ionization in the mass spectrometer.

23941 (CONF-9505101–1) **Batch test equilibration studies examining the removal of Cs, Sr, and Tc from supernatants from ORNL underground storage tanks by selected ion exchangers.** Collins, J.L.; Egan, B.Z.; Anderson, K.K.; Chase, C.W.; Bell, J.T. Oak Ridge National Lab., TN (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Conference on challenges and innovations in the management of hazardous waste; Washington, DC (United States); 10-12 May 1995. Order Number DE95013204. Source: OSTI; NTIS; INIS; GPO Dep.

Bench-scale batch equilibration tests have been conducted with supernatants from two underground tanks at the Melton Valley Storage Tank (MVST) Facility at Oak Ridge National Laboratory (ORNL) to determine the effectiveness of selected ion exchangers in removing cesium, strontium, and technetium. Seven sorbents were evaluated for cesium removal, nine for strontium removal, and four for technetium removal. The results indicate that granular potassium cobalt hexacyanoferrate was the most effective of the exchangers evaluated for removing cesium from the supernatants. The powdered forms of sodium titanate (NaTiO) and crystalline silicotitanate (CST) were superior in removing the strontium; however, for the sorbents of suitable particle size for column use, titanium monohydrogen phosphate (TiHP ϕ), sodium titanate/polyacrylonitrile (NaTiO-PAN), and titanium monohydrogen phosphate/polyacrylonitrile (TiP-PAN) gave the best results and were about equally effective. Reillex™ 402 was the most effective exchanger in removing the technetium; however, it was only slightly more satisfactory than Reillex™ HPQ.

23942 (CONF-950853–3) **Numerical predictions of the separation of heavy components inside the trace gas concentrator.** Mo, J.D. (Univ. of Memphis, TN (United States). Mechanical Engineering Dept.); Szady, A.J. Oak Ridge National Lab., TN (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Subcontract SR301-85-RC. From ASME/JSME annual summer meeting of the Fluids Engineering conference; Hilton Head, SC (United States);

13-17 Aug 1995. Order Number DE95013039. Source: OSTI; NTIS; INIS; GPO Dep.

The component with a heavier molecular weight can be separated from the one with a lighter molecular weight in a binary mixture by applying an appropriate pressure gradient. A centrifugal force field effectively generates the required pressure gradient and a favorable flow field along the radial direction in a trace gas concentrator for such an application. This paper presents the numerical predictions of the mass separation inside a trace gas concentrator, which enriches Xenon in air. A Navier-Stokes solver in primitive variables using a pressure based algorithm has been applied to solve for the flow fields. Subsequently, the transport equations with a strong centrifugal field are solved for the mass concentration. This study is the continued effort for the proof-of-concept of centrifugal separation of components with a considerable difference in their molecular weight in a binary mixture. The significant effects of rotational speed, flow field, and the geometrical configuration on the mass separation are presented in this paper.

23943 (DOE/ER/14315–T2) **The hydrophobic character of nonsulfide mineral surfaces as influenced by double-bond reactions of adsorbed unsaturated collector species. Progress report, 15 December 1992–14 December 1995.** Miller, J.D. Utah Univ., Salt Lake City, UT (United States). Dept. of Metallurgical Engineering. Jun 1995. 273p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-93ER14315. Order Number DE95015116. Source: OSTI; NTIS; GPO Dep.

Goal is to provide a basis for improved flotation separation efficiency in nonsulfide minerals by establishing the collector (surfactant) adsorption reactions and developing appropriate surface chemistry control strategies. In-situ measurements of surfactant adsorption were made for selected nonsulfide mineral systems using FT-IR/IRS with reactive internal reflection elements. The IRS adsorption density equation was developed to measure the surfactant adsorption, and its validity was confirmed using transferred Langmuir-Blodgett films. Order and organization of adsorbed surfactants were established from linear dichroism spectroscopy. Hydrophobicity and stability of adsorbed surfactants at mineral surfaces can now be explained. The surface charge/collector colloid adsorption mechanism was used to explain the anomalous behavior of KCl and flotation of double salts (schoenite, kainite, borax, etc.) from saturated brines. Adsorbing surfactnat colloids at salt surfaces in brines were studied by photon correlation spectroscopy and atomic force microscopy. Studies are being initiated of the interparticle forces in soluble salt flotation and of interfacial water near hydrophilic and hydrophobic surfaces.

23944 (DOE/MC/30024–95/C0495) **Applicability of atomic fluorescence and atomic absorption spectroscopy for on-line analysis of mercury in coal combustion and gasification effluents.** Norton, G.A.; Eckels, D.E. Ames Lab., IA (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (CONF-950839–1: Conference on particulate control/managing hazardous air pollutants, Toronto (Canada), 15-18 Aug 1995). Order Number DE95014986. Source: OSTI; NTIS; GPO Dep.

With the passage of the Clean Air Act Amendments of 1990, the on-line monitoring of mercury in effluents from coal combustors and gasifiers is receiving considerable interest. In this study, the applicability of using atomic fluorescence and atomic absorption techniques for on-line monitoring applications is discussed. Laboratory data obtained with two sensitive commercial mercury detectors (one fluorescence and one absorption unit) are presented to demonstrate general instrumental and analytical capabilities. Differences in instrument sensitivity, detection limits, dynamic range, quenching effects, and interferences are discussed.

23945 (KURRI-TR–393) **Proceeding of symposium on the fundamental knowledge and application of neutron activation analysis by a reactor.** Sasajima, Kazuhisa (ed.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jul 1994. 318p. (In Japanese, English). (CONF-9212138–: Symposium on the fundamental knowledge and application of neutron activation analysis by a reactor; Symposium on the fundamental knowledge and application of neutron activation analysis by a reactor; Symposium on the fundamental knowledge Order Number DE95789432. Source: OSTI; NTIS; INIS.

This issue is the collection of the papers presented at the title conference. The 31 of the presented papers are indexed individually. (J.P.N.).

23946 (LA-SUB–94-161) **Application to transfer radioactive waste to the Nevada Test Site.** Los Alamos National Lab., NM (United States); Gutierrez-Palmenberg, Inc. (United States). 1 Jun 1992. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95011841. Source: OSTI; NTIS; INIS; GPO Dep.

All waste described in this application has been, and will be, generated by LANL in support of the nuclear weapons test program at the NTS. All waste originates on the NTS. DOE Order 5820.2A states that low-level radioactive waste shall be disposed of at the site where it is generated, when practical. Since the waste is produced at the NTS, it is cost effective for LANL to dispose of the waste at the NTS.

23947 (UCRL-JC–119349) **Pyrochemical processing of Idaho Chemical Processing Plant (ICPP) High Level Waste (HLW) calcine.** Bronson, M.C. (Lawrence Livermore National Lab., CA (United States)); Ebbinghaus, B.B.; Riley, D.C.; Nelson, L.; Del Debbio, J. Lawrence Livermore National Lab., CA (United States). 15 Nov 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9502108–1: 1995 annual Metallurgical Society meeting, Las Vegas, NV (United States), 12-16 Feb 1995). Order Number DE95014516. Source: OSTI; NTIS; INIS; GPO Dep.

Inertial force damping control by micromanipulator modulation is proposed to suppress the vibrations of a micro/macro-manipulator system. The proposed controller, developed using classical control theory, is added to the existing control system. The proposed controller uses real-time measurements of macro-manipulator flexibility to adjust the motion of the micro manipulator to counteract structural vibrations. Experimental studies using an existing micro/macro flexible link manipulator testbed demonstrate the effectiveness of the proposed approach to suppression of vibrations in the macro/micro-manipulator system using micromanipulator-based inertial active damping control.

23948 (UCRL-JC–119739) **Photolytic destruction of oxalate in aqueous mixed waste.** Wang, F.T.; Lum, B.Y. Lawrence Livermore National Lab., CA (United States). Mar 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950877–12: 3. American Society for Mechanical Engineers biannual mixed waste symposium, Baltimore, MD (United States), 7-11 Aug 1995). Order Number DE95014133. Source: OSTI; NTIS; INIS; GPO Dep.

In aqueous plutonium processing, residual oxalic acid can be destroyed (oxalate kill) by UV light with hydrogen peroxide (H_2O_2) in 1 M HCl solutions. By controlling the amount of H_2O_2, the oxalate kill process will not affect the chloride concentration. In nitric acid solutions, UV light alone can destroy the oxalic acid. However, with H_2O_2, the rate of destruction is faster. After the destruction of oxalic acid, the acidic solutions may be reusable without further purification process.

23949 (UCRL-JC–119844) **The use of capacitive deionization with carbon aerogel electrodes to remove inorganic contaminants from water.** Farmer, J.C.; Fix, D.V.; Mack, G.V.; Pekala, R.W.; Poco, J.F. Lawrence Livermore National Lab., CA (United States). 17 Feb 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950718–1: Electric Power Research Institute low-level waste conference, Orlando, FL (United States), 10-12 Jul 1995). Order Number DE95013455. Source: OSTI; NTIS; INIS; GPO Dep.

The capacitive deionization of water with a stack of carbon aerogel electrodes has been successfully demonstrated for the first time. Unlike ion exchange, one of the more conventional deionization processes, no chemicals were required for regeneration of the system. Electricity was used instead. Water with various anions and cations was pumped through the electrochemical cell. After polarization, ions were electrostatically removed from the water and

held in the electric double layers formed at electrode surfaces. The water leaving the cell was purified, as desired.

4002 Inorganic, Organic, and Physical Chemistry

Refer also to citation(s) 22986, 22987, 22992, 22993, 22998, 23433, 23435, 23436, 23437, 23438, 23439, 23440, 23441, 23442, 23443, 23444, 23445, 23872, 23874, 23927, 24644, 24645, 24654, 24655, 24656, 24657, 24658, 24659, 24660, 24661, 24662, 24663, 24664, 24665, 24666, 24667, 24668, 24669, 24670, 24671, 24672, 24673, 24674, 24675, 24676, 24677, 24678, 24679, 24683, 24684, 24685, 24686, 24687, 24688, 24689, 24690, 24691, 24692, 24693, 24694, 24695

23950 (ANL/CMT/CP–84826) **A theory for correlating the thermodynamic and structural properties of molten silicate solutions.** Blander, M.; Bloom, I. Argonne National Lab., IL (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950265–2: Harold A. Oeye international symposium, Trondheim (Norway), 2-3 Feb 1995). Order Number DE95012946. Source: OSTI; NTIS; GPO Dep.

A theory of molten silicates is presented which takes into account the dependence of the free energy of cutting Si-O-Si bridging bonds on local structures of the two silicons in the bond. Resultant equations describe the thermodynamic properties of primary silicate solutions containing a mixture of bridges and cut bridges, and should ultimately provide a realistic measure of the distribution of silicon species which have i cut bridges (i = 1,2,3,4) from analyses of thermodynamic data.

23951 (BNL–61802) **Surface crystallization in normal-alkanes and alcohols.** Deutsch, M. (Bar Ilan Univ., Ramat-Gan (Israel). Physics Dept.); Ocko, B.M.; Wu, X.Z.; Sirota, E.B.; Sinha, S.K. Brookhaven National Lab., Upton, NY (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950183–3: Recontres de Moriond workshop, Villar-sur-Ollon (Switzerland), 21-28 Jan 1995). Order Number DE95013312. Source: OSTI; NTIS; GPO Dep.

A new, rare surface freezing, phenomenon is observed in molten normal-alkanes and their derivatives (alcohols, thiols, etc.). X-ray and surface tension measurements show the formation of a crystalline monolayer on the surface of the liquid alkane at temperatures up to 3 C above the bulk solidification temperature, T_f. For alcohols, a single bilayer is formed. In both cases, the molecules in the layer are hexagonally packed and oriented normal to the surface for short chain lengths, and tilted for long ones. In both cases the single layer persists down to T_f. In terms of wetting theory, this constitutes a very limited partial wetting of the liquid surface by the crystalline layer. The new surface phase is obtained only for chain lengths $14 < n \leq 50$ in alkanes, and $16 < n < 30$ in alcohols. The measurements are satisfactorily accounted for within a simple theory based on surface energy considerations.

23952 (DOE/CE/23810–46) **Measurement of viscosity, density, and gas solubility of refrigerant blends in selected synthetic lubricants. Final report.** Cavestri, R.C. (Imagination Resources, Inc., Dublin, OH (United States)). Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). 15 May 1995. 195p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE95013301. Source: OSTI; NTIS; GPO Dep.

The lubricants tested in this project were chosen based on the results of liquid/liquid miscibility tests. EMKARATE RL32S and Emery 2968A were selected. The Vapor Liquid Equilibrium (VLE) viscosity reduction and gas fractionation of each was measured with three different refrigerant blends: (1) R-404A; (2) R-507; and (3) R-407C. In addition, the four single refrigerants that make up the blends, HFC-32, HFC-125, HFC-134a, and HFC-143a, were also measured. Lubricants found to have the lowest liquid/liquid miscibilities had nearly equal viscosity reduction profiles as did the more miscible lubricants. Analytical methodology consisted of maintaining equally both the composition of the head space vapor above the lubricant/refrigerant mixture, and the composition of the liquid blend refrigerant. Blends with large temperature glides were re-evaluated in order to test the concept of head space quality and a vented piston hydraulic cylinder assembly was developed to perform this task. Fluid property data, above critical temperature and pressure conditions, is presented for the two lubricants with HFC-32, HFC-125, HFC-143a refrigerants. This research shows that the lubricant EMKARATE RL32S, which had the lowest (poorest) liquid/liquid miscibilities with the selected refrigerants, also had nearly equal viscosity reduction profiles to the more miscible Emery 2968A lubricant. The analytical methodology consisted of maintaining the composition of the refrigerant gas above the lubricant to be equal in composition to that of the pure liquid refrigerant blend being introduced into the lubricant. Refrigerant blends with large temperature glides were re-evaluated in order to validate the concept of the importance of the composition of the gas over the lubricant. To do perform this task, a special vented piston hydraulic cylinder assembly was developed. Fluid property data is also presented for HFC-32, HFC-125, and HFC-143a above the critical temperature and pressure of each.

23953 (DOE/ER/13439–T5) **Infrared absorption spectroscopy and chemical kinetics of free radicals. Final performance report, August 1, 1985–July 31, 1994.** Curl, R.F.; Glass, G.P. Rice Univ., Houston, TX (United States). Dept. of Chemistry. [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85ER13439. Order Number DE95013504. Source: OSTI; NTIS; GPO Dep.

This research was directed at the detection, monitoring, and study (by infrared absorption spectroscopy) of the chemical kinetic behavior of small free radical species thought to be important intermediates in combustion. The work typically progressed from the detection and analysis of the infrared spectrum of combustion radical to the utilization of the infrared spectrum thus obtained in the investigation of chemical kinetics of the radical species. The methodology employed was infrared kinetic spectroscopy. In this technique the radical is produced by UV flash photolysis using an excimer laser and then its transient infrared absorption is observed using a single frequency cw laser as the source of the infrared probe light. When the probe laser frequency is near the center of an absorption line of the radical produced by the flash, the transient infrared absorption rises rapidly and then decays as the radical reacts with the precursor or with substances introduced for the purpose of studying the reaction kinetics or with itself. The decay times observed in these studies varied from less than one microsecond to more than one millisecond. By choosing appropriate time windows after the flash and the average infrared detector signal in a window as data channels, the infrared spectrum of the radical may be obtained. By locking the infrared probe laser to the center of the absorption line and measuring the rate of decay of the transient infrared absorption signal as the chemical composition of the gas mixture is varied, the chemical kinetics of the radical may be investigated. In what follows the systems investigated and the results obtained are outlined.

23954 (DOE/ER/13442–9) **Energy transfer properties and mechanisms. Technical progress report.** Barker, J.R. Michigan Univ., Ann Arbor, MI (United States). Dept. of Atmospheric, Oceanic and Space Sciences. 3 Feb 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER13442. Order Number DE95013818. Source: OSTI; NTIS; INIS; GPO Dep.

Collisional energy transfer is the controlling factor in many nonequilibrium chemical systems: combustion, laser-induced chemical reactions, shock-heated gases, atmospheric chemistry, etc. During this period, efforts were made in 3 areas: large molecule energy transfer experiments (organic compounds); triatomic V-T/R energy transfer (memory effects); and energy transfer in extreme environments (shock tube data on norbornene). Results are described very briefly.

23955 (DOE/ER/13460–2) **Energies of organic compounds. Technical progress report.** Wiberg, K.B. Yale Univ., New Haven, CT (United States). Dept. of Chemistry. 12 Aug 1987. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13460. Order Number DE95014702. Source: OSTI; NTIS; GPO Dep.

A procedure was developed for carbonyl group reduction using triethylborohydride. Esters and lactones are readily reduced and are suitable as substrates. Some enthalpies of hydrolysis of lactones and esters were measured. Heats of trifluoroacetolysis of alkenes leading to tertiary alcohols were measured; some cyclic systems were also investigated. In order to study the effect of α-alkyl substituents on ketones, rotational barriers adjacent to carbonyl groups were studied.

23956 (DOE/ER/13460–T3) **Energies of organic compounds. Final report.** Yale Univ., New Haven, CT (United States). Dept. of Chemistry. [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13460. Order Number DE95014547. Source: OSTI; NTIS; GPO Dep.

The objective of this research was to gain information on the energies of organic compounds and on the factors that control energies. The work involved calorimetric measurements of energy changes and theoretical studies of intramolecular interactions and molecular energies.

23957 (DOE/PC/91030–T9) **Methyl chloride via oxyhydrochlorination of methane. Quarterly technical progress report No. 8, July–September 1993.** Dow Corning Corp., Carrollton, KY (United States). Jan 1994. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91030. Order Number DE95014338. Source: OSTI; NTIS; GPO Dep.

Significant progress was made in four different technical areas during this quarter. These key highlights are: In the catalyst definition work, it was found that there seems to be a definite correlation between active catalysts and catalyst crystallinity as shown by peaks in the XRD patterns. This could be indicative of the active site of oxyhydrochlorination on the catalyst; in the separation unit operation definition the feasibility of the chosen technology was established. Using a laboratory absorber column attached directly to an OHC screening reactor, very high removal percentages for CH_3Cl were shown; a final scope for the PDU was determined. The finalization of the scope definition work allowed the completion of a project design package which was used to refine the estimates of the work to be done during detail engineering; and groundbreaking for the PDU occurred. Site preparation work began. Demolition work was completed where existing equipment and piping was removed from a defunct pilot plant. Some minor paving work was also completed during this period at the site.

23958 (DOE/PC/91030–T10) **Methyl chloride via oxyhydrochlorination of methane. Quarterly technical progress report No. 10, January 1944–March 1994.** Dow Corning Corp., Carrollton, KY (United States). Aug 1994. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91030. Order Number DE95014337. Source: OSTI; NTIS; GPO Dep.

In work related to the design and construction of the Process Development Unit (PDU) this quarter involved further detail design and a real start to the construction activities. Status updates are given below for each discipline in the Task 2.0 and 3.0 headings. This work is progressing well. with the caveat of several small slips in the scheduling. On the catalyst development front this quarter was extremely productive. Many catalyst screening experiments were completed and they showed that control of the reaction exotherm is going to be quite challenging under PDU conditions. The presence of much more efficient reactor design and the ability to maintain closer to isothermal conditions is expected to give a significant advantage in actual PDU operation. A major concern at the moment is the cost of La in the catalyst being used. An action plan to remedy this is being put together.

23959 (DOE/PC/91030–T11) **Methyl chloride via oxyhydrochlorination of methane. Quarterly technical progress report No. 11, April–June 1994.** Dow Corning Corp., Carrollton, KY (United States). Nov 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91030. Order Number DE95014336. Source: OSTI; NTIS; GPO Dep.

The purpose of this contract is to develop a process for converting light alkane gases to methyl chloride via oxyhydrochlorination using highly selective, stable catalysts in fixed-bed reactors designed to remove the large amount of heat generated, so as to control the reaction temperature. Further, the objective is to obtain the engineering data base necessary for developing a commercially feasible process and to evaluate the economics of the process. Significant progress was made in catalyst and PDU development this quarter. The key points of these developments are: Initial discussions have taken place with a catalyst supplier. United Catalysts, Inc. UCI came up with some good catalyst development suggestions and has agreed to produce a batch of catalyst for the PDU; previous plans for supply of methane for the PDU have fallen through. New options. including getting gas from Carrollton Utilities, are being evaluated; and PDU equipment installation is completed. and piping is 40% complete. The electrical work is close to being finished, and the instrumentation is underway.

23960 (DOE/PC/91030–T12) **Methyl chloride via oxyhydrochlorination of methane. Quarterly technical progress report No. 12, July–September 1994.** Dow Corning Corp., Carrollton, KY (United States). Nov 1994. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91030. Order Number DE95014335. Source: OSTI; NTIS; GPO Dep.

Significant progress was made in six different technical areas during this quarter. These key highlights are: (1) Mixed $LnCl_3$ solutions were successfully tested as substitutes for $LaCl_3$ in preparing OHC catalysts. This will dramatically lower the price of the catalyst. (2) Six catalyst samples were received from UCI. Each was made via either incipient wetness or compounded extrudate techniques. Four of the catalysts have been screened. All seem adequate. (3) Contact has opened with Calsicat as an alternate catalyst supplier to UCI. It should be valuable to draw from their catalyst expertise. (4) It has been decided to tie into the plant's natural gas source. Methods of cleaning up this stream are being investigated. (5) PDU construction completion is expected the first week in November. Pressure testing and punchout fix-up work remain to be completed. (6) Three new engineers were hired to work on the PDU. Half of the temporary operating procedures (TOP's) have been written. SOP completion date is targeted for the beginning of November.

23961 (LA-UR–95-1304) **A diethyl phosphonate containing oxazoline: Synthesis and characterization of monomer and homopolymer.** Hermes, R.E.; Thompson, R.D.; Valdez, L.S. Los Alamos National Lab., NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950801–1: 210. national meeting of the American Chemical Society, Chicago, IL (United States), 20-25 Aug 1995). Order Number DE95012074. Source: OSTI; NTIS; GPO Dep.

A diethyl phosphonate oxazoline monomer and its polymer have been synthesized. The monomer appears to polymerize via a ring-opening mechanism giving the expected polyethyleneimine backbone with pendant carbonyl groups. Two distinct molecular weights were produced during polymerization suggesting two mechanisms of chain growth. Studies are underway to elucidate the reasons for this. This polymer has potential as a metal-chelating agent.

23962 (LBL–36465) **Quantum theory of chemical reaction rates.** Miller, W.H. (Univ. of California, Berkeley, CA (United States). Dept. of Chemistry). Lawrence Berkeley Lab., CA (United States). Oct 1994. 11p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant CHE-8920690. (CONF-9410349–2: 38. conference on chemical research, chemical dynamics of transient species, Houston, TX (United States), 24-25 Oct 1994). Order Number DE95014770. Source: OSTI; NTIS; GPO Dep.

If one wishes to describe a chemical reaction at the most detailed level possible, i.e., its state-to-state differential scattering cross section, then it is necessary to solve the Schroedinger equation to obtain the S-matrix as a function of total energy E and total angular momentum J, in terms of which the cross sections can be calculated as given by equation (1) in the paper. All other physically observable attributes of the reaction can be derived from the cross sections. Often, in fact, one is primarily interested in the least detailed quantity which characterizes the reaction, namely its thermal rate constant, which is obtained by integrating Eq. (1) over all scattering angles, summing over all product quantum states, and

Boltzmann-averaging over all initial quantum states of reactants. With the proper weighting factors, all of these averages are conveniently contained in the cumulative reaction probability (CRP), which is defined by equation (2) and in terms of which the thermal rate constant is given by equation (3). Thus, having carried out a full state-to-state scattering calculation to obtain the S-matrix, one can obtain the CRP from Eq. (2), and then rate constant from Eq. (3), but this seems like "overkill"; i.e., if one only wants the rate constant, it would clearly be desirable to have a theory that allows one to calculate it, or the CRP, more directly than via Eq. (2), yet also correctly, i.e., without inherent approximations. Such a theory is the subject of this paper.

23963 (LBL–37170) **Dynamics of inelastic and reactive gas-surface collisions.** Smoliar, L.A. Lawrence Berkeley Lab., CA (United States). Apr 1995. 143p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95014799. Source: OSTI; NTIS; GPO Dep.

The dynamics of inelastic and reactive collisions in atomic beam-surface scattering are presented. The inelastic scattering of hyperthermal rare gaseous atoms from three alkali halide surfaces (LiF, NaCl, GI)was studied to understand mechanical energy transfer in unreactive systems. The dynamics of the chemical reaction in the scattering of H(D) atoms from the surfaces of LIF(001) and the basal plane of graphite were also studied.

23964 (PNL-SA–24794) **Structure sensitive selectivity of the NO-CO reaction over rhodium single crystal catalysts.** Peden, C.H.F. (Pacific Northwest Lab., Richland, WA (United States)); Belton, D.N.; Schmieg, S.J. Pacific Northwest Lab., Richland, WA (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950561–1: 1. world conference on environmental catalysis for a better world and life: 529th event of the European Federation of Chemical Engineering, Pisa (Italy), 1-5 May 1995). Order Number DE95014627. Source: OSTI; NTIS; GPO Dep.

The control of automotive emissions of nitrogen oxides (NO_x) in passenger cars is accomplished by a heavy reliance on after-treatment of the engine exhaust using catalytic converters that contain a mixture of platinum (Pt), rhodium (Rh), and sometimes palladium (Pd). In this paper we examine the effect of surface structure on the NO-CO activity and selectivity by comparing the reactivity of Rh(110) and Rh(111) single crystal catalysts. Selectivity for the two possible nitrogen containing products from NO reduction, N_2O and N_2, is particularly interesting. Here we report that the selectivity of the NO-CO reaction is quite sensitive to the structure of the Rh catalyst metal surface. (A more complete description of these studies will be published elsewhere.) The more open Rh(110) surface tends to make significantly less N_2O than Rh(111) under virtually all conditions that we probed with these experiments. Furthermore, under the conditions used in this study, the NO-CO activity over Rh(110), as measured by the rate of NO loss, is somewhat faster than over Rh(111) with a lower apparent activation energy (Ea), 27.6 vs. 35.4 kcal/mol. We attribute these results to the greater tendency of the more open (110) surface to dissociate NO. Notably, more facile NO dissociation on Rh(110) would lead to greater steady-state concentrations of adsorbed N-atoms; thus, the (110) surface favors N-atom recombination over the surface reaction between adsorbed NO and N-atoms to make N_2O. In support of this, post-reaction surface analysis shows only NO on the Rh(111) surface while the Rh(110) surface contains predominantly N-atoms and much lower concentrations of adsorbed NO. NO dissociation on Rh(110) is more favorable than on Rh(111), in part, because it is less-severely poisoned by high surface concentrations of NO. In addition, the more-open (110) surface may be intrinsically more active for the elementary process of dissociating adsorbed NO.

23965 (SAND–95-0388) **Fullerene-based materials research and development. LDRD final report.** Cahill, P.A.; Henderson, C.C.; Rohlfing, C.M.; Loy, D.A.; Assink, R.A.; Gillen, K.T.; Jacobs, S.J.; Dugger, M.T. Sandia National Labs., Albuquerque, NM (United States). May 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012522. Source: OSTI; NTIS; GPO Dep.

The chemistry and physical properties of fullerenes, the third, molecular allotrope of carbon, have been studied using both experimental and computational techniques. Early computational work investigated the stability of fullerene isomers and oxides, which was followed by extensive work on hydrogenated fullerenes. Our work led to the first synthesis of a polymer containing C_{60} and the synthesis of the simplest hydrocarbon derivatives of C_{60} and C_{70}. The excellent agreement between theory and experiment ($\pm$ 0.1 kcal/mol in the relative stability of isomers) has provided insight into the chemical nature of fullerenes and has yielded a sound basis for prediction of the structure of derivatized fullerenes. Such derivatives are the key to the preparation of fullerene-based materials.

23966 (SAND–95-1063) **Multicomponent three-phase equilibria.** Ho, C.K. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014491. Source: OSTI; NTIS; GPO Dep.

This paper presents the relations that describe thermodynamic equilibrium in a three-phase system. Multiple components, including air, water, and oil components, are considered in three phases: (1) aqueous, (2) oil, and (3) gas. Primary variables are specified for each of seven possible phase combinations. These primary variables are then used to determine the necessary secondary variables to completely describe the system. Criteria are also developed to check the stability of each phase configuration and determine possible transitions from one phase configuration to another phase configuration via phase appearances and disappearances.

23967 (SAND–95-8569) **Gas-phase chemistry during the conversion of cyclohexane to carbon: Flow reactor studies at low and intermediate pressure.** Osterheld, T.H.; Allendorf, M.D.; Larson, R. Sandia National Labs., Livermore, CA (United States). Jul 1995. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015377. Source: OSTI; NTIS; GPO Dep.

The gas-phase branching during the conversion of cyclohexane to solid carbon has been measured in a high-temperature-flow reactor. The experiments show that cyclohexane decomposes into a broad distribution of hydrocarbons that further decompose into the more kinetically stable products hydrogen, methane, acetylene, ethylene, benzene, and PAH. At 1363 K, the evolution to these species occurs quickly. We also observe the buildup of significant amounts of aromatic molecules at later stages in the decomposition, with as much as 15% of the total carbon in PAH and 25% in benzene. At later stages, the gas-phase molecules react slowly, even though the system is not at equilibrium, because of their kinetic stability and the smaller radical pool. The decomposition does not appear to depend sensitively on pressure in the regime of 25 to 250 torr. Thus, to a first approximation, these results can be extrapolated to atmospheric pressure.

23968 (UCRL-ID–118655) **Hydrogen chemisorption on diamond surfaces. Final report.** Daley, R.; Musket, R. Lawrence Livermore National Lab., CA (United States). Sep 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015844. Source: OSTI; NTIS; GPO Dep.

Previously we demonstrated the ability to measure submonolayer quantities of surface hydrogen on insulating glasses. The present study builds on this by examining hydrogen coverages on another insulating material: the technologically important diamond (100) surface. The information to be obtained in the present study will allow us to deduce the correct structures for the diamond (100)-(1X1) and -(2X1) surface phases and provide information on the kinetics of hydrogen desorption from the (100) surface. Such experiments are essential for a complete understanding of hydrogen surface chemistry during the chemical vapor deposition of thin diamond films. This report summarizes progress made in FY93 for measuring surface hydrogen concentrations on the diamond (100) surface. Although the available LDRD resources were insufficient to finish this study in FY93, completion of the study is planned using other resources and this detailed report as a reference.

4004 Electrochemistry

Refer also to citation(s) 23773, 23877

23969 (UCRL-ID–119263) **Capacitive deionization of water: An innovative new process.** Farmer, J. (and others); Fix, D.; Mack, G. Lawrence Livermore National Lab., CA (United States). 9 Jan 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950917–12: 5. international conference on radioactive waste management and environmental remediation, Berlin (Germany), 3-9 Sep 1995). Order Number DE95015848. Source: OSTI; NTIS; GPO Dep.

The capacitive deionization of water with a stack of carbon aerogel electrodes has been successfully demonstrated for the first time. Unlike ion exchange, one of the more conventional deionization processes, no chemicals were required for regeneration of the system. Electricity was used instead. Water with various anions and cations was pumped through the electrochemical cell. After polarization, ions were electrostatically removed from the water and held in the electric double layers formed at electrode surfaces. The water leaving the cell was purified, as desired.

4005 Photochemistry

23970 (ANL/CHM/CP–86825) **Structure-function relationships of second hyperpolarizabilities in two-dimensional molecules.** Chen, L.X. (Argonne National Lab., IL (United States)); Mandal, B.K.; Bihari, B. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950793–3: 40. annual meeting of the Society of Photo-Optical Instrumentation Engineers: international symposium on optical science, engineering and instrumentation, San Diego, CA (United States), 9-14 Jul 1995). Order Number DE95014233. Source: OSTI; NTIS; GPO Dep.

The enhancement of the third order susceptibilities $X^{(3)}$ and second order molecular hyperpolarizabilities $<\gamma>$ in a series of covalently stacked dimer and trimer macrocycles (SiPc and SiNc) was observed through the phase conjugated signals from DFWM measurements at both 1064 and 532 nm. The FWHM of the phase conjugated signals at 532 nm is much smaller than those at 1064 nm and those of the reference compound CS_2. The $<\gamma>$ values at both wavelengths as a function of number of the monomer units (n) have an approximate n^3 dependence, differing only in the scaling constant. The origin of such enhancement is discussed and compared to those in one-dimensional π-conjugated systems.

4006 Radiation Chemistry

23971 (ANL/CHM/CP–85693) **Excess charges in semiconductor nanocrystallites.** Laungdilok, C. (Argonne National Lab., IL (United States). Chemistry Div.); Lawless, D.; Cook, A.R.; Meisel, D. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505228–1: 48. Society for Imaging Science and Technology (IS&T) annual conference, Washington, DC (United States), 7-12 May 1995). Order Number DE95013404. Source: OSTI; NTIS; INIS; GPO Dep.

The authors explore in this report the effects of excess electrons on the edge of the absorption spectrum of small semiconductor particles. The presence of these charges leads to strong bleaching of the absorption at the exciton region and to slight enhancement of the absorption on both sides of the bleaching. They show that the effect is independent of the origin of the charge; it occurs whether the charge is injected into the particle or only attached to its surface, and it appears even when the charge is deeply localized within the band gap. They conclude that the effect arises from the electric field associated with the charge and not from its presence in the band.

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 23133, 23872, 23874, 24346

23972 (IAERU–9304, pp. 239-244) **A comment on the future studies on classical hot atom chemistry.** Matsuura, Tatsuo (Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Dec 1993. (CONF-9210482–: International seminar on the chemistry of high energy atoms, Tokyo (Japan), 28-30 Oct 1992). In *Proceedings of the international seminar on the chemistry of high energy atoms.* 270p. Order Number DE95709895. Source: OSTI; NTIS; INIS.

Classical hot atom chemistry can still provide useful information on fundamental aspects such as the intermolecular and intramolecular energy transfer processes. Here, we propose some ideas concerning the retention to be studied both from the experimental and theoretical points of view in the framework of classical hot atom chemistry. (author).

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 23416, 23714, 23809, 23953, 23954, 24031, 24570

23973 (SAND–95-8497C) **A conservative Low Mach number projection method for reacting flow modelling.** Najm, H.N. Sandia National Labs., Livermore, CA (United States). [1995]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950731–1: 8. international symposium on transport phenomena in combustion, San Francisco, CA (United States), 16-20 Jul 1995). Order Number DE95010754. Source: OSTI; NTIS; GPO Dep.

A conservative Low Mach number predictor-corrector projection scheme is developed, and implemented on reacting flow in a closed domain. The stagnation pressure is computed with an integral constraint that allows a conservative update of the density field using the non-conservative energy equation and the continuity equation. A premixed flame-vortex interaction is studied to examine the mutual effects of unsteady flow and reaction at the flame front. Second order convergence is demonstrated. Flame statistics axe reported and compared to available data. A super-adiabatic condition is observed behind the flame due to the pressure rise in the domain. The implications for flame response to the flow field are studied, revealing significant deviation from one-dimensional stagnation flame behaviour. Time history effects related to pressure rise are found to have a significant role in determining the flame peak reaction rate response to flow induced stretch.

23974 (SAND–95-8531) **Sandia Combustion Research: Technical review.** Sandia National Labs., Livermore, CA (United States). 1995. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014027. Source: OSTI; NTIS; GPO Dep.

This report contains reports from research programs conducted at the Sandia Combustion Research Facility. Research is presented under the following topics: laser based diagnostics; combustion chemistry; reacting flow; combustion in engines and commercial burners; coal combustion; and industrial processing. Individual projects were processed separately for entry onto the DOE databases.

42 ENGINEERING

Refer also to citation(s) 25016

4202 Facilities, Equipment, and Techniques

Refer also to citation(s) 23130, 23134, 23135, 23151, 23197, 23223, 23224, 23273, 23303, 23304, 23346, 23375, 23379, 23390, 23565, 23576, 23577, 23752, 23779, 23796, 24027, 24237, 24248, 24356, 24376, 24408, 24757, 25000, 25019, 25033

23975 (ANL/ET/CP–82671) **Remote disassembly of irradiated tritium-bearing lithium-bonded capsules.** Tsai, H. (Argonne National Lab., IL (United States). Energy Technology Div.); Strain,

R.V.; Donahue, D.A.; Savoie, F.E.; Evans, D.A.; Neimark, L.A. Argonne National Lab., IL (United States). Sep 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950232–37: 6. American Nuclear Society meeting on robotics and remote systems, Monterey, CA (United States), 5-10 Feb 1995). Order Number DE95013687. Source: OSTI; NTIS; INIS; GPO Dep.

Seven irradiated tritium-bearing lithium-bonded capsules containing vanadium alloy specimens were disassembled in a hot-cell facility at Argonne National Laboratory. These capsules were irradiated in the Fast Flux Test Facility as part of the structural materials research for the Fusion Power Program. The principal concern in disassembling these capsules to retrieve the test specimens was the hazard associated with the residual bonded tritium, which ranged from ~17 to 99 Ci per capsule. This tritium had to be contained to the maximum extent possible. An enclosed system was built in which the authors used liquid ammonia to dissolve the lithium bond, alcohol to rinse and clean the retrieved specimens, and chemical getters (containing a reactive metal alloy) to trap the released tritium gas. The main processing units of the system are inside a hot cell and the remainder are in a vented cabinet. Essentially all of the tritium in the capsules was either trapped in the getters or confined in the solid reaction residues in beakers of spent ammonia and alcohol. There was no personnel contamination or accidental tritium release during the entire procedure.

23976 (BNL–52454) **Dynamic response of a pair of walls retaining a viscoelastic solid.** Veletsos, A.S.; Parikh, V.H.; Younan, A.H.; Bandyopadhyay, K. Brookhaven National Lab., Upton, NY (United States). Jan 1995. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95012092. Source: OSTI; NTIS; GPO Dep.

Making use of a previously reported, simple, approximate method of analysis, a critical evaluation is made of the dynamic pressures and forces induced by horizontal ground shaking on a pair of infinitely long, parallel walls retaining a uniform viscoelastic solid. The walls are presumed to be rigid but elastically constrained against rotation at their base. The effects of both harmonic and earthquake-induced excitations are examined. The accuracy of the method is assessed by comparing its predictions for the special case of fixed-based walls with those obtained by an exact method, and comprehensive numerical data are presented which elucidate the underlying response mechanisms, and the effects and relative importance of the parameters involved. The parameters examined include the characteristics of the ground motion, the ratio of the distance between walls to the height of the contained material, and the flexibility of the rotational wall constraints. In addition to valuable insights into the responses of the systems investigated, the results presented provide a convenient framework for the analysis of more complex systems as well.

23977 (CONF-9506200–1) **The relative degree enhancement problem for MIMO nonlinear systems.** Schoenwald, D.A. (Oak Ridge National Lab., TN (United States)); Oezguener, Ue. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From International Federation on Automatic Control (IFAC) symposium on nonlinear control systems design; Tahoe City, CA (United States); 25-28 Jun 1995. Order Number DE95013983. Source: OSTI; NTIS; GPO Dep.

The authors present a result for linearizing a nonlinear MIMO system by employing partial feedback - feedback at all but one input-output channel such that the SISO feedback linearization problem is solvable at the remaining input-output channel. The partial feedback effectively enhances the relative degree at the open input-output channel provided the feedback functions are chosen to satisfy relative degree requirements. The method is useful for nonlinear systems that are not feedback linearizable in a MIMO sense. Several examples are presented to show how these feedback functions can be computed. This strategy can be combined with decentralized observers for a completely decentralized feedback linearization result for at least one input-output channel.

23978 (CONF-9506200–2) **Stabilization of nonlinear systems with parametric uncertainty using variable structure techniques.** Schoenwald, D.A. (Oak Ridge National Lab., TN (United States)); Oezguener, Ue. Oak Ridge National Lab., TN (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From International Federation on Automatic Control (IFAC) symposium on nonlinear control systems design; Tahoe City, CA (United States); 25-28 Jun 1995. Order Number DE95013982. Source: OSTI; NTIS; GPO Dep.

The authors present a result on the robust stabilization of a class of nonlinear systems exhibiting parametric uncertainty. They consider feedback linearizable nonlinear systems with a vector of unknown constant parameters perturbed about a known value. A Taylor series of the system about the nominal parameter vector coupled with a feedback linearizing control law yields a linear system plus nonlinear perturbations. Via a structure matching condition, a variable structure control law is shown to exponentially stabilize the full system. The novelty of the result is that the linearizing coordinates are completely known since they are defined about the nominal parameter vector, and fewer restrictions are imposed on the nonlinear perturbations than elsewhere in the literature.

23979 (DOE/CE/23810–51F) **Investigation of flushing and clean-out methods for refrigeration equipment to ensure system compatibility. Quarterly technical progress report, September 15, 1994–December 15, 1994.** Byrne, J.J. (Integral Sciences, Inc., Columbus, OH (United States)). Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE95015361. Source: OSTI; NTIS; GPO Dep.

Integral Sciences Incorporated is engaged in Part 2 of ARTI Contract No. 660-52502 assessing methods for removing residual mineral oil during retrofits of refrigeration systems. Part 2 focuses on a low side oil separator technique for removing mineral oil from systems being retrofitted to use HFC-134a. The method appears less expensive than the current practice of three lubricant changes with polyolester and may effect an accelerated transition to HFC's. Testing and method verification has been performed using a refrigeration system located at ISI's facility. Two HFC-134a field retrofits employing this method will be implemented during the first quarter of 1995. A third and final field retrofit will also be performed to evaluate the advanced method in an R-502 conversion.

23980 (DOE/CE/23810–59) **Materials compatibility and lubricants research on CFC-refrigerant substitutes. Quarterly MCLR program technical progress report, January 1, 1995–March 31, 1995.** Szymurski, S.R.; Hourahan, G.C.; Godwin, D.S. Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). Apr 1995. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE95016148. Source: OSTI; NTIS; GPO Dep.

The Materials Compatibility and Lubricants Research (MCLR) program supports critical research to accelerate the introduction of CFC and HCFC refrigerant substitutes. The MCLR program addresses refrigerant and lubricant properties and materials compatibility. The primary elements of the work include data collection and dissemination, materials compatibility testing, and methods development. The work is guided by an Advisory Committee consisting of technical experts from the refrigeration and air-conditioning industry and government agencies. The Air-Conditioning and Refrigeration Technology Institute, Inc., (ARTI) manages and contracts multiple research projects and a data collection and dissemination effort. Detailed results from these projects are reported in technical reports prepared by each subcontractor.

23981 (DOE/MC–92113-4016) **Interactive Computer-Enhanced Remote Viewing System (ICERVS). Phase 2.** Tourtellott, J. Mechanical Technology, Inc., Latham, NY (United States). Nov 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29113. Order Number DE95000086. Source: OSTI; NTIS; GPO Dep.

This report documents the results of the Phase 2 development of ICERVS. Supporting the USDOE missions in environmental restoration, ICERVS integrates capabilities for data acquisition, data visualization, data analysis, and geometric model synthesis in

a workstation-based system. The following sections trace ICERVS development from intermediate system design, prototyping of critical elements, and detailed design of seven subsystems through implementation of source code and system performance testing. As a result of Phase 2, ICERVS has demonstrated the combined capabilities of integration and display of 3D sensor data, and interactive synthesis and display of geometric shapes to model regions in 3D space. Such capabilities are essential to effective, efficient task planning, path planning, and collision avoidance in robotic remediation systems.

23982 (DOE/NE/37967–T10) **University Research Programs in Robotics annual technical progress report, June 1, 1994–May 31, 1995.** Florida Univ., Gainesville, FL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86NE37967. Order Number DE95012909. Source: OSTI; NTIS; GPO Dep.

The University of Florida supported three technical areas within the US Department of Energy's Robotics Technology Development Program (RTDP) during this project period: Tank Waste Retrieval (TWR) Analysis Automation (CAA), and Cross-Cutting and Advanced Technology (CC&AT). This reports the technical progress made on the tasks for each of these areas. Detailed reports will be sent to the RTDP coordinator and the project area coordinators at the end of the project period.

23983 (HW–11321) **234-5 Project specification letter 234-41, 235-41 (Supplement D), Chemical Development Laboratory.** Work, J.B. Hanford Works, Richland, WA (United States). 22 Oct 1948. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014057. Source: OSTI; NTIS; GPO Dep.

This letter itemizes the miscellaneous equipment and supplies not previously specified which should be ordered to equip the 234-5 Chemical Development Laboratory. Equipment currently carried in store stock is not included in this list. The vendor is given only to identify the item or as a suggested source of supply.

23984 (HW–24514) **Critical mass studies of plutonium solutions.** Kruesi, F.E.; Erkman, J.O.; Lanning, D.D. Hanford Works, Richland, WA (United States). 19 May 1952. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95013948. Source: OSTI; NTIS; GPO Dep.

The chain reacting conditions for plutonium nitrate in water solution have been examined experimentally for a variety of sizes of spheres and cylinders. The effects on the critical mass of the displacement of hydrogen and the addition of poisons to the fuel were measured in water tamped and bare reactors. In this report the data obtained in the investigation is presented graphically and in tables. Some preliminary analysis has been made yielding the results: (i) the absorption cross-section of Pu^{240} is 925 $\pm$ 200 barns and (ii) the minimum critical mass of Pu^{239} in water is 510 grams at concentration of about 33 grams per liter.

23985 (HW–25374) **Critical mass study of 231 process tanks.** Lanning, D.D. Hanford Works, Richland, WA (United States). 19 Aug 1952. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014106. Source: OSTI; NTIS; GPO Dep.

An estimated minimum critical mass for each of the process vessels in the 231 Building has been calculated on the basis of critical mass data given in the P-11 Project Document HW-24514. The calculations are made assuming the plutonium to be a homogeneous mixture of precipitate and water with some slight neutron poisoning due to other elements. The precipitate is further assumed to have partially settled making an effectively infinite water reflector above the plutonium and hence reducing the critical mass.

23986 (KCP–613-5570) **Risk management in design engineering bids.** Hudgins, D.W. (AlliedSignal Inc., Kansas City, MO (United States). Kansas City Division); Lavelle, J.P. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Jun 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. (CONF-9505235–1: Industrial Engineering Research conference, Nashville, TN (United States), 25-26 May 1995). Order Number DE95013996. Source: OSTI; NTIS; GPO Dep.

Accurate engineering cost estimates are critical in developing bids for new work, and for effective resource allocation and project control. This study reports on design estimating methods found in the literature, and on the results of two empirical studies of how estimating techniques are used in professional practice and their accuracy. The study found great reliance on a classic "activity analysis" approach to estimating design resources, and significant hazards in commonly used parametric techniques. The study found that project managers expect their estimates to be accurate (with 80% confidence interval) of between -10% to +25%. The study also found that actual bids between engineering firms had a much greater range (-40% to +45%) than can be explained by accuracy. Perhaps most importantly the study found that none of the sampled design firms used probabilistic techniques to optimize their project bids or to manage financial risk in view of the uncertainty of their estimates. The study concludes with techniques to reduce risk, and recommended future study.

23987 (LBL-PUB–754, pp. 3-11) **A compact permanent magnet cyclotrino for accelerator mass spectrometry.** Young, A.T. (Lawrence Berkeley Lab., CA (United States)); Clark, D.J.; Kunkel, W.B.; Leung, K.N.; Li, C.Y. Lawrence Berkeley Lab., CA (United States). Feb 1995. DOE Contract AC03-76SF00098. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

The authors describe the development of a new instrument for the detection of trace amounts of rare isotopes, a Cyclotron Mass Spectrometer (CMS). A compact low energy cyclotron optimized for high mass resolution has been designed and has been fabricated. The instrument has high sensitivity and is designed to measure carbon-14 at abundances of $< 10^{-12}$. A novel feature of the instrument is the use of permanent magnets to energize the iron poles of the cyclotron. The instrument uses axial injection, employing a spiral inflector. The instrument has been assembled and preliminary measurements of the magnetic field show that it has a uniformity on the order of 2 parts in 10^4.

23988 (LBL-PUB–754, pp. 75-84) **Halbach arrays in precision motion control.** Trumper, D.L. (Massachusetts Institute of Technology, Cambridge, MA (United States)); Williams, M.E. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

The Halbach array was developed for use as an optical element in particle accelerators. Following up on a suggestion from Klaus Halbach, the authors have investigated the utility of such arrays as the permanent magnet structure for synchronous machines in cartesian, polar, and cylindrical geometries. Their work has focused on the design of a novel Halbach array linear motor for use in a magnetic suspension stage for photolithography. This paper presents the details of the motor design and its force and power characteristics.

23989 (LBL-PUB–754, pp. 85-100) **Halbach array motor/generators: A novel generalized electric machine.** Merritt, B.T. (Lawrence Livermore National Lab., CA (United States)); Post, R.F.; Dreifuerst, G.R.; Bender, D.A. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

For many years Klaus Halbach has been investigating novel designs for permanent magnet arrays, using advanced analytical approaches and employing a keen insight into such systems. One of his motivations for this research was to find more efficient means for the utilization of permanent magnets for use in particle accelerators and in the control of particle beams. As a result of his pioneering work, high power free-electron laser systems, such as the ones built at the Lawrence Livermore Laboratory, became feasible, and his arrays have been incorporated into other particle-focusing systems of various types. This paper reports another, quite different, application of Klaus' work, in the design of high power, high efficiency, electric generators and motors. When

tested, these motor/generator systems display some rather remarkable properties. Their success derives from the special properties which these arrays, which the authors choose to call "Halbach arrays," possess.

23990 (LBL-PUB–754, pp. 175-181) **Optimum coil shape for a given volume of conductor to obtain maximum central field in an air core solenoid.** Hernandez, P. (Lawrence Berkeley Lab., CA (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

This paper is an expansion of engineering notes prepared in 1961 to address the question of how to wind circular coils so as to obtain the maximum axial field with the minimum volume of conductor. At the time this was a germain question because of the advent of superconducting wires which were in very limited supply, and the rapid push for generation of very high fields, with little concern for uniformity.

23991 (ORNL–6817) **Instrumentation and Controls Division Progress report, July 1, 1992–June 30, 1994.** McDonald, D.W. Oak Ridge National Lab., TN (United States). Jun 1995. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014466. Source: OSTI; NTIS; GPO Dep.

The Instrumentation and Controls (I&C) Division serves a national laboratory, and as such has an expansive domain: science, industry, and national defense. The core mission is to support the scientific apparatus of the Laboratory and all of the systems that protect the safety and health of people and the environment. Progress is reported for the five sections: photonics and measurements systems, electronic systems, signal processing, controls and systems integration, and technical support.

23992 (ORNL/TM–12374) **Criticality safety studies of Building 3019 Cell 4 and in-line storage wells.** Primm, R.T. III. Oak Ridge National Lab., TN (United States). Nov 1993. 151p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95016201. Source: OSTI; NTIS; INIS; GPO Dep.

New fissile material load limits for storage facilities located in Building 3019 are derived in a manner consistent with currently applicable Martin Marietta Energy Systems requirements. The limits for ^{233}U loading are 2.00, 1.80, 1.45, and 0.19 kg/ft for hydrogen-to-^{233}U atoms ratios of 3, 5, 10, and unrestricted, respectively. Limits were also found for ^{235}U and ^{239}Pu systems. The KENO-Va Monte Carlo Program and Hansen-Roach cross sections were used to derive these limits.

23993 (ORNL/TM–12732) **Prediction of parallel NIKE3D performance on the KSR1 system.** Su, P.S. (Oak Ridge National Lab., TN (United States)); Zacharia, T.; Fulton, R.E. Oak Ridge National Lab., TN (United States). May 1995. 14p. Sponsored by USDOE, Washington, DC (United States);Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC05-84OR21400. Order Number DE95014486. Source: OSTI; NTIS; GPO Dep.

Finite element method is one of the bases for numerical solutions to engineering problems. Complex engineering problems using finite element analysis typically imply excessively large computational time. Parallel supercomputers have the potential for significantly increasing calculation speeds in order to meet these computational requirements. This paper predicts parallel NIKE3D performance on the Kendall Square Research (KSR1) system. The first part of the prediction is based on the implementation of parallel Cholesky (U^TDU) matrix decomposition algorithm through actual computations on the KSR1 multiprocessor system, with 64 processors, at Oak Ridge National Laboratory. The other predictions are based on actual computations for parallel element matrix generation, parallel global stiffness matrix assembly, and parallel forward/backward substitution on the BBN TC2000 multiprocessor system at Lawrence Livermore National Laboratory. The preliminary results indicate that parallel NIKE3D performance can be attractive under local/shared-memory multiprocessor system environments.

23994 (ORNL/TM–12813-Pt.2) **New insights into input relegation control for inverse kinematics of a redundant manipulator. Part 2, The optimization of a secondary criteria involving self motion of the joints.** Unseren, M.A. Oak Ridge National Lab., TN (United States). Jul 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014899. Source: OSTI; NTIS; GPO Dep.

The input relegation control (IRC) technique for redundancy resolution is extended to solve the problem of optimizing a scalar performance criteria representing a secondary objective to be accomplished via self motion of the joints. The criteria is defined to be the error between the vector of joint velocities and a new vector of "corrective' joint velocities, which is minimized in a Eudidean norm sense. The corrective velocities represent a 'corrective' action to be applied to the system and axe projected into the null space of the Jacoblan in the solution for the joint velocities. The report demonstrates that there exists a component in the solution for the joint velocities that induces self motion of the joints but is not a function of the "corrective action". A technique for eliminating this undesired component is presented. The method is compared to the well known gradient projection technique and its advantages are discussed.

23995 **Flexible pipe crawling device.** Zollinger, W.T. 1993. Filed date 24 May 1993. U.S. Patent Application 8-064,880. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95015045. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of an apparatus for moving through the linear and non-linear segments of piping systems. The apparatus comprises a front leg assembly, a rear leg assembly, means for extension and retraction of said front and rear leg assembles with respect to each other, such as an air cylinder, and a pivoting joint. One end of the flexible joint attaches to the front leg assembly and the other end to the air cylinder, which is also connected to the rear leg assembly. The air cylinder allows the front and rear leg assemblies to progress through pipe in "inchworm" fashion, while the joint provides the flexibility necessary for the pipe crawler to negotiate non-linear piping segments. The flexible connecting joint is coupled with a spring-force suspension system that urges alignment of the front and rear leg assemblies with respect to each other. The joint and suspension system cooperate to provide a firm yet flexible connection between the front and rear leg assemblies to allow the pivoting of one with respect to the other while moving around a non-linear pipe segment, but restoring proper alignment coming out of the pipe bend.

23996 **Carbon-assisted flyer plates.** Paisley, D.L.; Stahl, D.B. 1993. Filed date 28 May 1993. U.S. Patent Application 8-068,032. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015039. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of a laser driven flyer plate utilizing an optical fiber connected to a laser. The end of the optical fiber has a layer of carbon and a metal layer deposited onto it. The carbon layer provides the laser induced plasma which is superior to the plasma produced from most metals. The carbon layer plasma is capable of providing a flatter flyer plate, converting more of the laser energy to driving plasma, promoting a higher flyer plate acceleration, and providing a more uniform pulse behind the plate. In another embodiment, the laser is in optical communication with a substrate onto which a layer of carbon and a layer of metal have been deposited.

23997 (PNL-SA–24733) **TEDANN: Turbine engine diagnostic artificial neural network.** Kangas, L.J. (Pacific Northwest Lab., Richland, WA (United States)); Greitzer, F.L.; Illi, O.J. Jr. Pacific Northwest Lab., Richland, WA (United States). 17 Mar 1994. 16p. Sponsored by Department of Defense, Washington, DC (United States). (CONF-9403233–1: Advanced information systems and technology conference, Williamsburg, VA (United States), 28-30 Mar 1994). Order Number DE95014609. Source: OSTI; NTIS; GPO Dep.

The initial focus of TEDANN is on AGT-1500 fuel flow dynamics: that is, fuel flow faults detectable in the signals from the Electronic

Control Unit's (ECU) diagnostic connector. These voltage signals represent the status of the Electro-Mechanical Fuel System (EMFS) in response to ECU commands. The EMFS is a fuel metering device that delivers fuel to the turbine engine under the management of the ECU. The ECU is an analog computer whose fuel flow algorithm is dependent upon throttle position, ambient air and turbine inlet temperatures, and compressor and turbine speeds. Each of these variables has a representative voltage signal available at the ECU's J1 diagnostic connector, which is accessed via the Automatic Breakout Box (ABOB). The ABOB is a firmware program capable of converting 128 separate analog data signals into digital format. The ECU's J1 diagnostic connector provides 32 analog signals to the ABOB. The ABOB contains a 128 to 1 multiplexer and an analog-to-digital converter, CP both operated by an 8-bit embedded controller. The Army Research Laboratory (ARL) developed and published the hardware specifications as well as the micro-code for the ABOB Intel EPROM processor and the internal code for the multiplexer driver subroutine. Once the ECU analog readings are converted into a digital format, the data stream will be input directly into TEDANN via the serial RS-232 port of the Contact Test Set (CTS) computer. The CTS computer is an IBM compatible personal computer designed and constructed for tactical use on the battlefield. The CTS has a 50MHz 32-bit Intel 80486DX processor. It has a 200MB hard drive and 8MB RAM. The CTS also has serial, parallel and SCSI interface ports. The CTS will also host a frame-based expert system for diagnosing turbine engine faults (referred to as TED; not shown in Figure 1).

23998 (PNL-SA–25597) **Development of a flexible thermosyphon for cooling a concentrated heat source.** McKee, R.S.; Hobbs, F.D. Pacific Northwest Lab., Richland, WA (United States). May 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9505155–3: 9. international heat pipe conference, Albuquerque, NM (United States), 1-5 May 1995). Order Number DE95014608. Source: OSTI; NTIS; GPO Dep.

A flexible tubular thermosyphon was developed for the purpose of cooling a concentrated heat source. Designed to fold 180° for storage and unfold for operation, the thermosyphon is made of copper and uses water as the working fluid. Its integral flex-joint has several advantages over conventional flexible joints. A unique boiling enhancement improved the liquid-to-vapor phase change while minimizing the conduction-temperature drop from the tube wall to the fluid, and was found to perform better than a screen wick in the evaporator. A study of the power limits and of other working fluids was conducted with the HTPIPE computer code (Los Alamos). Power limits were calculated to be far in excess of what was needed, but experiments revealed that the limits were significantly lower. Water was predicted to be the best working fluid at the operational temperature range but this was not experimentally verified.

23999 (PNL-SA–26161) **Micro-manipulator motion control to suppress macro-manipulator structural vibrations.** Lew, J.Y.; Trudnowski, D.J.; Evans, M.S.; Bennett, D.W. Pacific Northwest Lab., Richland, WA (United States). May 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9505193–5: 1995 international conference on robotics and automation, Nagoya (Japan), 21-27 May 1995). Order Number DE95014614. Source: OSTI; NTIS; GPO Dep.

The feasibility of several pyrochemical approaches for separating non-radioactive constituents from ICPP BLW calcine were examined. The removal of aluminum as $AlCl_3$ from aluminia calcine was successfully demonstrated. The examination of pyrochemical processes to remove non-radioactive constituents, primarily aluminium, zirconium, calcium and fluorine, from zirconia calcine showed that fluorine removal was required inorder to chlorinate the calcine. A molten calcium chloride wash, a calcium reduction, and a sulfuric acid treatment were examined as possible zirconia calcine pretreatment options for fluorine removal. Fluorine removal from simulated ICPP zirconia calcine was demonstrated by both a $CaCl_2$ wash method and a sulfuric acid treatment method. X-ray fluorescence analysis indicated that greater than 97% of the fluorine can be removed by either method. Fluorine removal by a calcium reduction using an alloying agent, zinc, or a calcium reduction using a filtration separation were also demonstrated, but the efficiencies of fluorine removal were considerably less ranging from 50 to 90%.

24000 (SAND–95-0849C) **Motion planning for multiple moving objects.** Hwang, Y.K. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9508119–1: 1. international symposium on assembly and task planning, Pittsburgh, PA (United States), 10-11 Aug 1995). Order Number DE95011888. Source: OSTI; NTIS; GPO Dep.

We present a motion planner for multiple moving objects in two dimensions. The search for collision-free paths is performed in the composite configuration space of all the moving objects to guarantee a solution, and the efficiency of our planner is demonstrated with examples. Our motion planner can be characterized with a hierarchical, multi-resolution search of the configuration space along with a generate-and-test paradigm for solution paths. Because of the high dimensionality of the composite configuration space, our planner is most useful for cases with a small number of moving objects. Some of the potential applications are navigation of several mobile robots, and planning part motions for a multi-handed assembly operation.

24001 (SAND–95-0935C) **Determination of modal residues and residual flexibility for time-domain system realization.** Alvin, K.F. (Sandia National Labs., Albuquerque, NM (United States)); Peterson, L.D. Sandia National Labs., Albuquerque, NM (United States). [1995]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9509140–2: 15. ASME international computer in engineering conference, Boston, MA (United States), 17-21 Sep 1995). Order Number DE95011884. Source: OSTI; NTIS; GPO Dep.

A linear least-squares procedure for the determination of modal residues using time-domain system realization theory is presented. The present procedure is shown to be theoretically equivalent to residue determination in realization algorithms such as the Eigensystem Realization Algorithm (ERA) and Q-Markov COVER. However, isolating the optimal residue estimation problem from the general realization problem affords several advantages over standard realization algorithms for structural dynamics identification. Primary among these are the ability to identify data sets with large numbers of sensors using small numbers of reference point responses, and the inclusion of terms which accurately model the effects of residual flexibility. The accuracy and efficiency of the present realization theory-based procedure is demonstrated for both simulated and experimental data.

24002 (SAND–95-1195C) **Command shaping for residual vibration free crane maneuvers.** Parker, G.G.; Petterson, B.; Dohrmann, C.; Robinett, R.D. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950653–2: 1995 American control conference, Seattle, WA (United States), Jun 1995). Order Number DE95013864. Source: OSTI; NTIS; GPO Dep.

Cranes used in the construction and transportation industries are generally devices with multiple degrees of freedom including variable load-line length, variable jib length (usually via a trolley), and variable boom angles. Point-to-point payload maneuvers using cranes are performed so as not to excite the spherical pendulum modes of their cable and payload assemblies. Typically, these pendulum modes, although time-varying, exhibit low frequencies. Current crane maneuvers are therefore performed slowly contributing to high construction and transportation costs. This investigation details a general method for applying command shaping to various multiple degree of freedom cranes such that the payload moves to a specified point without residual oscillation. A dynamic programming method is used for general command shaping for optimal maneuvers. Computationally, the dynamic programming approach requires order M calculations to arrive at a solution, where M is the number of discretizations of the input commands. This feature is exploited for the crane command shaping problem allowing for rapid calculation of command histories. Fast generation of commands is a necessity for practical use of command shaping for the applications described in this work. These results are compared to

near-optimal solutions where the commands are linear combinations of acceleration pulse basis functions. The pulse shape is required due to hardware requirements. The weights on the basis functions are chosen as the solution to a parameter optimization problem solved using a Recursive Quadratic Programming technique. Simulation results and experimental verification for a variable load-line length rotary crane are presented using both design procedures.

24003 (SAND–95-1235C) **Current status and future research in motion planning.** Hwang, Y.K. Sandia National Labs., Albuquerque, NM (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9508119–2: 1. international symposium on assembly and task planning, Pittsburgh, PA (United States), 10-11 Aug 1995). Order Number DE95013868. Source: OSTI; NTIS; GPO Dep.

There have been numerous research efforts in the field of motion planning, resulting in many theoretical and practical results. We review the current status of existing motion planning algorithms, evaluate their completeness and efficiencies on modern computers, and suggest fruitful future research directions.

24004 (SAND–95-1272C) **High shock, high frequency characteristics of a mechanical isolator for a piezoresistive accelerometer.** Bateman, V.I. (and others); Brown, F.A.; Davie, N.T. Sandia National Labs., Albuquerque, NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506213–1: 18. transducer workshop, Colorado Springs, CO (United States), 20-22 Jun 1995). Order Number DE95014604. Source: OSTI; NTIS; GPO Dep.

A mechanical isolator has been developed for a piezoresistive accelerometer. The purpose of the isolator is to mitigate high frequency shocks before they reach the accelerometer because the high frequency shocks may cause the accelerometer to resonate. Since the accelerometer is undamped, it often breaks when it resonates. The mechanical isolator was developed in response to impact test requirements for a variety of structures at Sandia National Laboratories. An Extended Technical Assistance Program with the accelerometer manufacturer has resulted in a commercial isolator that will be available to the general public. This mechanical isolator has ten times the bandwidth of any other commercial isolator and has acceptable frequency domain performance from DC to 10 kHz (± 10%) over a temperature range of -65°F to +185°F as demonstrated in this paper.

24005 (SAND–95-8564C) **The expanded role of software in a control system.** Damico, J.P. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9507127–1: National Instruments week, Austin, TX (United States), 23 Jul 1995). Order Number DE95010762. Source: OSTI; NTIS; GPO Dep.

Disposal of hazardous wastes such as chemical waste and military munitions present a serious environmental challenge. A new technology, Supercritical Water oxidation (SCWO), provides a safer, cleaner process for disposing of these and other wastes. Sandia National Laboratories built a SCWO reactor, called the Engineering Evaluation Reactor (EER) to study the SCWO process. Designed as a flexible testbed, the EER required a control system that would accommodate a variety of experimental instruments, configurations and control schemes. Safety concerns required that the control system remotely operate the reactor. In the past, such a control system would be custom built from hardware components. The EER control system implemented many hardware functions in software and proved more flexible than a hardware oriented system. This paper describes the design and implementation of the EER control and data acquisition system and discusses the advantages of a software based control system. The EER control system forms a virtual instrument by incorporating all reactor controls and sensor data displays into a graphical user interface. The operator remotely controls the reactor with a mouse and observes the reactor status from onscreen displays. In more hardware oriented designs, the system controls, like switches, dials, and panel meters, are mounted in instrument panels. The instrument panels can be designed to present an intuitive user interface, but modifications to the experiment would require expensive control panel hardware modifications. Often, the control system interface does not reflect experiment changes and becomes nonintuitive and unsafe. Considering the constant changes planned for the EER, we implemented the control system using software wherever possible.

24006 (UCRL-JC–117482) **Recent test results of a warm gas pumped monopropellant propulsion system.** Frei, T.E. (Olin Aerospace Co., Redmond, WA (United States)); Maybee, J.C.; Whitehead, J.C. Lawrence Livermore National Lab., CA (United States). 13 Jun 1994. 14p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940623–3: 30. joint propulsion conference and exhibit, Indianapolis, IN (United States), 27-29 Jun 1994). Order Number DE95011694. Source: OSTI; NTIS; GPO Dep.

Updated test results from system level testing of an advanced pumped hydrazine propulsion system are presented. The results are from testing the next iteration of a system previously tested in 1991 through 1993. This novel propulsion system is the central part of a miniature maneuvering vehicle which has been presented and discussed in various configurations in previous papers and recently successfully flight tested on the ASTRID rocket. Noteworthy design features include flight packaging of the propulsion system (excluding tanks), enabled by the use of a flight design thrust control valve assembly and a miniature gas generator (GG) fuel control valve (13 gms). The pumped propulsion system is a significant achievement in state-of-the-art hydrazine system performance, achieved largely through the use of free-piston warm gas pumps 3.6.7. The pumps enable high performance by using low pressure and thus light weight propellant tank(s). A GG provides warm gas to both drive the pumps and for tank repressurization via a pressure reducing valve. The pumps boost the fuel pressure from tank pressure (60 psig) up to 1200 psig. The high pressure fuel is fed to the light weight high performance thrusters (56 lbf thrust) and to the GG, regulated to 960 psi. The recent testing includes a 60-second steady-state firing and dual thruster firing at sea level, in addition to boostrap and pulse mode firings. At the completion of this testing the system operation was nominal and further life margin testing is currently under-way. Additionally, future work includes transfer of this technology and its performance benefits to civilian/commercial launch vehicle staging.

24007 (UCRL-JC–117890) **Evaporation monitoring and composition control of alloy systems with widely differing vapor pressures.** Anklam, T.M.; Berzins, L.V.; Braun, D.G.; Haynam, C.; McClelland, M.A.; Meier, T. Lawrence Livermore National Lab., CA (United States). Oct 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410109–1: 11. electron beam melting and refining conference - state of the art 1994, Reno, NV (United States), 30 Oct - 1 nov 1994). Order Number DE95011764. Source: OSTI; NTIS; INIS; GPO Dep.

Lawrence Livermore National Laboratory is developing sensors and controls to improve and extend electron beam materials processing technology to alloy systems with constituents of widely varying vapor pressure. The approach under development involves using tunable lasers to measure the density and composition of the vapor plume. A laser based vaporizer control system for vaporization of a uranium-iron alloy has been previously demonstrated in multi-hundred hour, high rate vaporization experiments at LLNL. This paper reviews the design and performance of the uranium vaporization sensor and control system and discusses the extension of the technology to monitoring of uranium vaporization. Data is presented from an experiment in which titanium wire was fed into a molten niobium pool. Laser data is compared to deposited film composition and film cross sections. Finally, the potential for using this technique for composition control in melting applications is discussed.

24008 (UCRL-JC–118151) **New infrared solid state laser materials for CALIOPE.** DeLoach, L.D. (and others); Page, R.H.; Wilke, G.D. Lawrence Livermore National Lab., CA (United States). 1 Aug 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9404162–20:

1994 chemical analysis by laser interrogation of proliferation effluents (CALIOPE ITR) interim technical review, Livermore, CA (United States), 26-28 Apr 1994). Order Number DE95014160. Source: OSTI; NTIS; INIS; GPO Dep.

Tunable infrared laser light may serve as a useful means by which to detect the presence of the targeted effluents. Since optical parametric oscillators (OPOs) have proven to be a versatile method of generating coherent light from the ultraviolet to the mid-infrared, this technology is a promising choice by which to service the CALIOPE applications. In addition, since some uncertainty remains regarding the precise wavelengths and molecules that will be targeted, the deployment of OPOs retains the greatest amount of wavelength flexibility. Another approach that the authors are considering is that of generating tunable infrared radiation directly with a diode-pumped solid state laser (DPSSL). One important advantage of a DPSSL is that it offers flexible pulse format modes that can be tailored to meet the needs of a particular application and target molecule. On the other hand, direct generation by a tunable DPSSL will generally be able to cover a more limited wavelength range than is possible with OPO technology. In support of the CALIOPE objectives the authors are exploring the potential for laser action among a class of materials comprised of transition metal-doped zinc chalcogenide crystals (i.e., ZnS, ZnSe and ZnTe). The Cr^{2+}, Co^{2+} and Ni^{2+} dopants were selected as the most favorable candidates, on the basis of their documented spectral properties in the scientific literature. Thus far, the authors have characterized the absorption and emission properties of these ions in the ZnS and ZnSe crystals. The absorption spectra are used to determine the preferred wavelength at which the crystal should be pumped, while the emission spectra reveal the extent of the tuning range potentially offered by the material. In addition, measurements of the emission lifetime as a function of temperature turn out to be quite useful, since this data is suggestive of the room temperature emission yield.

24009 (UCRL-JC–118185) **Process simulator for time-dependent material and energy flow in a continuous casting system.** Westerberg, K.W. (Aspen Technology, Inc., Cambridge, MA (United States)); McClelland, M.A. Lawrence Livermore National Lab., CA (United States). 6 Feb 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9509118–7: Modeling of casting, welding and advanced solidification processes 7, London (United Kingdom), 10-15 Sep 1995). Order Number DE95014695. Source: OSTI; NTIS; GPO Dep.

A process simulator is developed for the material and energy flow in a continuous casting system which utilizes an electron-beam energy source. A time-dependent, one-dimensional model is used which accounts for energy transport within the ingot and transport to the surroundings by conduction, thermal radiation, and the formation of secondary electrons. Also included are the mass and energy additions associated with the poured metal. A modified finite element method is used to solve the energy equation while tracking boundaries at the pool surface and solidification zone. Model parameters are determined using results from a steady-state experiment and a more detailed two-dimensional model for fluid flow and energy transport. For a transient experiment with pouring, a comparison is made between predicted and measured heat flows.

24010 (UCRL-JC–119080) **Near-surface current meter array measurements of internal gravity waves.** Mantrom, D.D.; Jones, H.E.; Chambers, D.H. Lawrence Livermore National Lab., CA (United States). 3 Nov 1994. 8p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950244–1: 5. IEEE working conference on current measurement: upper ocean, boundary layer, moving platform, and non-invasive current measurements, St. Petersburg, FL (United States), 7-9 Feb 1995). Order Number DE95011697. Source: OSTI; NTIS; GPO Dep.

A measurement capability using a horizontal array of 10 S4 current meters mounted on a stiff floating structure with 35m aperture has been developed to support interpretation of radar imaging of surface effects associated with internal gravity waves. This system has been fielded three times and most recently, has collected data alongside the sea-surface footprint of a land-fixed radar imaging ship-generated internal waves. The underlying need for this measurement capability is described. The specifications resulting from this need are presented and the engineering design and deployment procedures of the platform and systems that resulted are described. The current meter data are multiplexed along with meteorological and system status data onboard the floating platform and are telemetered to a shore station and on to a data acquisition system. The raw data are recorded, and are then processed to form space-time images of current and strain rate (a spatial derivative of the current field). Examples of raw and processed data associated with ship-generated internal waves are presented.

24011 (UCRL-JC–120009) **Development of high damage threshold optics for petawatt-class short-pulse lasers.** Stuart, B.C. (and others); Perry, M.D.; Boyd, R.D. Lawrence Livermore National Lab., CA (United States). 22 Feb 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950226–52: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95014367. Source: OSTI; NTIS; INIS; GPO Dep.

The authors report laser-induced damage threshold measurements on pure and multilayer dielectrics and gold-coated optics at 1053 and 526 nm for pulse durations, τ, ranging from 140 fs to 1 ns. Damage thresholds of gold coatings are limited to 500 mJ/cm^2 in the subpicosecond range for 1053-nm pulses. In dielectrics, qualitative differences in the morphology of damage and a departure from the diffusion-dominated $\tau 1/2$ scaling indicate that damage results from plasma formation and ablation for $\tau \lesssim 10$ ps and from conventional melting and boiling for $\tau > 50$ ps. A theoretical model based on electron production via multiphoton ionization, Joule heating, and collisional (avalanche) ionization is in quantitative agreement with both the pulsewidth and wavelength scaling of experimental results.

24012 (UCRL-JC–120300) **Modeling the dynamic crush of impact mitigating materials.** Logan, R.W.; McMichael, L.D. Lawrence Livermore National Lab., CA (United States). 12 May 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950740–54: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95013268. Source: OSTI; NTIS; INIS; GPO Dep.

Crushable materials are commonly utilized in the design of structural components to absorb energy and mitigate shock during the dynamic impact of a complex structure, such as an automobile chassis or drum-type shipping container. The development and application of several finite-element material models which have been developed at various times at LLNL for DYNA3D will be discussed. Between the models, they are able to account for several of the predominant mechanisms which typically influence the dynamic mechanical behavior of crushable materials. One issue we addressed was that no single existing model would account for the entire gambit of constitutive features which are important for crushable materials. Thus, we describe the implementation and use of an additional material model which attempts to provide a more comprehensive model of the mechanics of crushable material behavior. This model combines features of the pre-existing DYNA models and incorporates some new features as well in an invariant large-strain formulation. In addition to examining the behavior of a unit cell in uniaxial compression, two cases were chosen to evaluate the capabilities and accuracy of the various material models in DYNA. In the first case, a model for foam filled box beams was developed and compared to test data from a 4-point bend test. The model was subsequently used to study its effectiveness in energy absorption in an aluminum extrusion, spaceframe, vehicle chassis. The second case examined the response of the AT-400A shipping container and the performance of the overpack material during accident environments selected from 10CFR71 and IAEA regulations.

24013 (UCRL-JC-120672) **Modeling, monitoring and control based on neural networks.** Fu, Chi Yung. Lawrence Livermore National Lab., CA (United States). 14 Apr 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950412–15: Spring meeting of the Materials Research Society (MRS), San Francisco, CA (United

States), 17-21 Apr 1995). Order Number DE95012455. Source: OSTI; NTIS; GPO Dep.

The cost of a fabrication line such as one in a semiconductor house has increased dramatically over the years and it is possibly already past the point that some new start-up company can have sufficient capital to build a new fabrication line. Such capital-intensive manufacturing needs better utilization of resources and management of equipment to maximize its productivity. In order to maximize the return from such a capital-intensive manufacturing line, we need to address the following: (1) increasing the yield, (2) enhancing the flexibility of the fabrication line, (3) improving quality, and finally (4) minimizing the down time of the processing equipment. Because of the significant advances now made in the fields of artificial neural networks, fuzzy logic, machine learning and genetic algorithms, we advocate the use of these new tools to in manufacturing. We term the applications of these and other tools that mimic human intelligence to manufacturing neural manufacturing. This paper will address the effort at Lawrence Livermore National Laboratory (LLNL) to use artificial neural networks to address certain semiconductor process modeling, monitoring and control questions.

24014 (WHC-EP–0859) **Measurements of the corrosion of low-carbon steel drums under environmental conditions at Hanford: One-year test results.** Duncan, D.R. (Westinghouse Hanford Co., Richland, WA (United States)); Bunnell, L.R. Westinghouse Hanford Co., Richland, WA (United States). May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95015548. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the methods used to expose low-carbon steel drums to atmospheric and soil corrosion and describes the methods used to examine specimens retrieved from both types of tests. These drums are being tested to meet requirements of radioactive waste storage for both low-level radioactive wastes and transuranic wastes.

24015 (WHC-SD-RTG-TC–006-Rev.1) **Test plan/procedure for the shock limiting device of the radioisotope thermoelectric generator package mounting subsystem 145. Revision 1.** Satoh, J.A. Westinghouse Hanford Co., Richland, WA (United States). 25 May 1995. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013904. Source: OSTI; NTIS; GPO Dep.

This document defines the procedure to be used in the 18 inch drop test to be used for design verification of the RTG Transportation System Package Mounting.

24016 (WHC-SD-SQA-CSA–20394) **CSER 95-003: Exemption from Criticality Alarm System requirement for 232-Z building.** Nirider, L.T.; Miller, E.M. Westinghouse Hanford Co., Richland, WA (United States). 18 May 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013340. Source: OSTI; NTIS; INIS; GPO Dep.

This CSER establishes an exemption for 232-Z from the requirement for a Criticality Alarm System, because the formation of a critical configuration is not a credible event for any circumstance involving the cleaning out and removal of the Burning Hood and associated equipment.

24017 (WHC-SD-TP-TP–007) **Test plan/procedure for the SPM-1 shipping container system. Revision 0.** Flanagan, B.D. Westinghouse Hanford Co., Richland, WA (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95014426. Source: OSTI; NTIS; INIS; GPO Dep.

The 49 CFR 173.465 Type A packaging tests will verify that SPM-1 will provide adequate protection and pass as a Type A package. Test will determine that the handle of the Pig will not penetrate through the plywood spacer and rupture the shipping container. Test plan/procedure provides planning, pre-test, setup, testing, and post-testing guidelines and procedures for conducting the "Free Drop Test" procedure for the SPM-1 package.

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Refer also to citation(s) 23578, 23607, 23973, 23997, 24383, 24979, 24999, 25002, 25018

24018 (ANL/IFR/CP–84612) **Hydrodynamic studies of post dryout two-phase downflow in narrow channels.** Eberle, C.S. (Argonne National Lab., Idaho Falls, ID (United States)); Ishii, M.; Revankar, S.T. Argonne National Lab., Idaho Falls, ID (United States). [1995]. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950828–13: National heat transfer conference, Portland, OR (United States), 5-9 Aug 1995). Order Number DE95014081. Source: OSTI; NTIS; INIS; GPO Dep.

An experimental study of the hydrodynamics of a narrow channel was performed in order to obtain the heat transfer mechanisms and influences contributing to the flow regime transition from inverted annular to inverted slug flows for post dryout downflow. The experimental series consisted of both adiabatic and diabatic visualization tests over a wide range of fluid and thermal parameters. The system inlet gas velocities ranged from 0 to 14 meters per second while the inlet fluid velocities ranged from 1 to 3 meters per second. Full extent visualization of the flow regime was possible due to a quartz tube in tube construction with a clear heating fluid. Constant temperature heating of the freon was accomplished at bulk fluid temperatures above the critical heat flux temperature. For each hydrodynamic flow condition, one to three minuets of VHS-video filming was performed to acquire both flow regime and break-up length data. In addition to this the flow field parameters were recorded simultaneously with the filming.

24019 (DOE/ER/13757–T6) **Fluid dynamics of double diffusive systems. Final report.** Koseff, J.R. Stanford Univ., CA (United States). Dept. of Civil Engineering. [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-87ER13757. Order Number DE95015455. Source: OSTI; NTIS; GPO Dep.

Over the past seven years the authors have conducted an experimental, numerical, and theoretical study of the stability of doubly diffusive systems, and of mixing processes in stratified turbulence. For the study of the stability of doubly diffusive systems continuous gradients of two diffusing components (heat and salinity in this case) were used as the initial condition, and forcing was introduced by lateral heating and surface shear. The goals of this work included (1) quantification of the effects of finite amplitude disturbances on stable, double diffusive systems, particularly with respect to lateral heating, (2) development of an improved understanding of the physical phenomena present in sheardriven flows in doubly diffusive stratified environments, (3) increasing their knowledge-base on turbulent flow in stratified environments and how to represent it, and (4) formulation of a numerical code for such flows. In particular, the overall goals of this aspect of the research were as follows: (1) develop more general stability and scaling criteria for the destabilization of doubly-stratified systems, (2) study the variation of flow structure and scales with Rayleigh ratio and lateral heating ratio, (3) delineate the mechanisms governing convective layer formation and merging, (4) study the mixing processes within the convective layers and across interfaces, and estimate the heat and mass fluxes in such a system, (5) quantify the effects of turbulence and coherent structures (due to a wind-driven surface shear) on a doubly stratified system, and (6) study the interaction between surface shear and side-wall heating destabilization mechanisms. Goals 1 through 4 have been successfully completed and the results are described in this report.

24020 (DOE/ER/14045–10) **Development and use of image scanning ellipsometer to study the dynamics of heated thin liquid films. Progress report, July 1, 1989–December 31, 1994.** Wayner, P.C. Jr.; Plawsky, J.L. Rensselaer Polytechnic Inst., Troy, NY (United States). Jan 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14045. Order Number DE95013812. Source: OSTI; NTIS; GPO Dep.

Long-term objective is to determine heat transfer and stability of evaporating ultra-thin films, some of which may form permanent coatings. Goal is to develop and use a microscopic image-processing system (IPS) to measure the film thickness profile; the

IPS has two parts: an image analyzing interferometer and an image scanning ellipsometer.

24021 (DOE/PN/38195–T2) **Numerical calculation of two-phase turbulent jets.** Saif, A.A. Purdue Univ., Lafayette, IN (United States). May 1995. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC11-93PN38195. Order Number DE95015702. Source: OSTI; NTIS; GPO Dep.

Two-phase turbulent round jets were numerically simulated using a multidimensional two-phase CFD code based on the two-fluid model. The turbulence phenomena were treated with the standard k-ϵ model. It was modified to take into account the additional dissipation of turbulent kinetic energy by the dispersed phase. Within the context of the two-fluid model it is more appropriate and physically justified to treat the diffusion by an interfacial force in the momentum equation. In this work, the diffusion force and the additional dissipation effect by the dispersed phase were modeled starting from the classical turbulent energy spectrum analysis. A cut-off frequency was proposed to decrease the dissipation effect by the dispersed phase when large size particles are introduced in the flow. The cut-off frequency combined with the bubble-induced turbulence effect allows for an increase in turbulence for large particles. Additional care was taken in choosing the right kind of experimental data from the literature so that a good separate effect test was possible for their models. The models predicted the experimental data very closely and they were general enough to predict extreme limit cases: water-bubble and air-droplet jets.

24022 (SAND–95-1189C) **A proposed methodology for computational fluid dynamics code verification, calibration, and validation.** Aeschliman, D.P.; Oberkampf, W.L.; Blottner, F.G. Sandia National Labs., Albuquerque, NM (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9507136–1: 16. international congress on instrumentation in aerospace simulation facilities, Dayton, OH (United States), 18-21 Jul 1995). Order Number DE95013862. Source: OSTI; NTIS; GPO Dep.

Verification, calibration, and validation (VCV) of Computational Fluid Dynamics (CFD) codes is an essential element of the code development process. The exact manner in which code VCV activities are planned and conducted, however, is critically important. It is suggested that the way in which code validation, in particular, is often conducted–by comparison to published experimental data obtained for other purposes–is in general difficult and unsatisfactory, and that a different approach is required. This paper describes a proposed methodology for CFD code VCV that meets the technical requirements and is philosophically consistent with code development needs. The proposed methodology stresses teamwork and cooperation between code developers and experimentalists throughout the VCV process, and takes advantage of certain synergisms between CFD and experiment. A novel approach to uncertainty analysis is described which can both distinguish between and quantify various types of experimental error, and whose attributes are used to help define an appropriate experimental design for code VCV experiments. The methodology is demonstrated with an example of laminar, hypersonic, near perfect gas, 3-dimensional flow over a sliced sphere/cone of varying geometrical complexity.

24023 (SAND–95-1196C) **A numerical model of 2-D sloshing of pseudo-viscous liquids in horizontally accelerated rectangular containers.** Romero, V.J. (Sandia National Labs., Albuquerque, NM (United States)); Ingber, M.S. Sandia National Labs., Albuquerque, NM (United States). [1995]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9507125–2: BEM 17: Boundary element methods, Madison, WI (United States), 17-19 Jul 1995). Order Number DE95013860. Source: OSTI; NTIS; GPO Dep.

A numerical model for simulating the transient nonlinear behavior of 2-D viscous sloshing flows in rectangular containers subjected to arbitrary horizontal accelerations is presented. The potential-flow formulation uses Rayleigh damping to approximate the effects of viscosity, and Lagrangian node movement is used to accommodate violent sloshing motions. A boundary element approach is used to efficiently handle the time-changing fluid geometry. Additionally, a corrected equation is presented for the constraint condition relating normal and tangential derivatives of the velocity potential where the fluid free surface meets the rigid container wall. The numerical model appears to be more accurate than previous sloshing models, as determined by comparison against exact analytic solutions and results of previously published models.

24024 (UCRL-JC–118609) **An adaptive multifluid interface-capturing method for compressible flow in complex geometries.** Greenough, J.A.; Beckner, V.; Pember, R.B.; Crutchfield, W.Y.; Bell, J.B.; Colella, P. Lawrence Livermore National Lab., CA (United States). Apr 1995. 10p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-48 ; FG03-92ER25140. IACRO 95-2045, DMS-8919074. (CONF-950634–4: 26. American Institute of Aeronautics and Astronautics (AIAA) computational fluid dynamics conference, San Diego, CA (United States), 19-22 Jun 1995). Order Number DE95013273. Source: OSTI; NTIS; GPO Dep.

We present a numerical method for solving the multifluid equations of gas dynamics using an operator-split second-order Godunov method for flow in complex geometries in two and three dimensions. The multifluid system treats the fluid components as thermodynamically distinct entities and correctly models fluids with different compressibilities. This treatment allows a general equation-of-state (EOS) specification and the method is implemented so that the EOS references are minimized. The current method is complementary to volume-of-fluid (VOF) methods in the sense that a VOF representation is used, but no interface reconstruction is performed. The Godunov integrator captures the interface during the solution process. The basic multifluid integrator is coupled to a Cartesian grid algorithm that also uses a VOF representation of the fluid-body interface. This representation of the fluid-body interface allows the algorithm to easily accommodate arbitrarily complex geometries. The resulting single grid multifluid-Cartesian grid integration scheme is coupled to a local adaptive mesh refinement algorithm that dynamically refines selected regions of the computational grid to achieve a desired level of accuracy. The overall method is fully conservative with respect to the total mixture. The method will be used for a simple nozzle problem in two-dimensional axisymmetric coordinates.

24025 (UCRL-JC–118610) **Numerical simulation of a waveguide mixing layer on a Cray C-90.** Greenough, J.A.; Crutchfield, W.Y.; Rendleman, C.A. Lawrence Livermore National Lab., CA (United States). 19 May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950634–3: 26. American Institute of Aeronautics and Astronautics (AIAA) computational fluid dynamics conference, San Diego, CA (United States), 19-22 Jun 1995). Order Number DE95013260. Source: OSTI; NTIS; GPO Dep.

The development of a three-dimensional spatially evolving compressible mixing layer is investigated numerically using a parallel implementation of Adaptive Mesh Refinement (AMR) on a Cray C-90. The parallel implementation allowed the flow to be highly resolved while significantly reducing the wall-clock runtime. A sustained computation rate of 5.3 Gigaflops including I/O was obtained for a typical production run on a 16 processor machine. A novel mixing layer configuration is investigated where a pressure mismatch is maintained between the two inlet streams. In addition, the sonic character of the two streams is sufficiently different so that the pressure relief wave is trapped in the high speed stream. The trapped wave forces the mixing layer to form a characteristic cellular pattern. The cellular structure introduces curvature into the mixing layer that excites centrifugal instabilities characterized by large-scale counter-rotating vortical pairs embedded within the mixing layer. These are the dominant feature of the flow. Visualizations of these structures in cross-section show the pumping action which lifts dense fluid up into light gas. This effect has a strong impact on mixing enhancement as monitored by a conserved scalar formulation. Once the large-scale structures axe well established in the flow and undergo intensification from favorable velocity gradients, the time-averaged integrated product shows almost a four-fold increase. A spectral analysis of the flow-field over the cellular structures. as part of a full space-time analysis, shows these structures to be zero-frequency modes that develop from low level essentially

broad-banded noise. This characterization of the vortical structures and their appearance is consistent with a recent linear stability analysis, of a mixing layer over a curved wall that predicts the most unstable modes to be zero frequency streamwise vortices.

4205 Materials Testing

Refer also to citation(s) 23535, 23573, 23873, 23880, 23980, 24082, 24216, 24399

24026 (CONF-9505100–1) **Microanalysis at atomic resolution.** Pennycook, S.J. (Oak Ridge National Lab., TN (United States). Solid State Div.); Jesson, D.E.; Browning, N.D.; Chisholm, M.F. Oak Ridge National Lab., TN (United States). [1995]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. European workshop on modern developments and applications in microbeam analysis: microbeam and nanobeam techniques; Saint-Malo (France); 14-18 May 1995. Order Number DE95013040. Source: OSTI; NTIS; GPO Dep.

In this paper the authors discuss how the dedicated scanning transmission electron microscope can provide a microanalysis of crystalline materials at atomic resolution. The method requires the establishment of incoherent conditions for a reference imaging signal as well as the spectroscopic signal. The image can then be used to focus and locate the probe to atomic precision for microanalysis. The Z-contrast image provides the most convenient incoherent reference image, and X-ray and electron energy loss data may be acquired simultaneously. In zone axis crystals, strong columnar channeling delays the onset of beam broadening for several hundred Angstroms, so that atomic resolution microanalysis may be achieved in materials specimens of significant thickness. This combination of signals provides a powerful means for studying interface structure and bonding, and avoids relying on preconceived model structures.

24027 (DOE/CE/23810–62A) **Compatibility of R-245ca with motor materials under retrofit conditions.** Doerr, R.G.; Waite, T.D. Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States);Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). DOE Contract FG02-91CE23810. (CONF-950624–2: Annual meeting of the American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE), San Diego, CA (United States), 24-28 Jun 1995). Order Number DE95015263. Source: OSTI; NTIS; GPO Dep.

This document, which is a reproduction of slides from a presentation at the June 1995 ASHRAE conference, evaluates and provides data on a number of motor parameters after the motor materials have been exposed to the refrigerant R-245ca. Data on conditions of the insulating varnish, the magnet wire, the insulations, and the elastomers are presented, as well as a note on work in progress. While it was concluded that most materials are compatible with R-245ca under retrofit conditions, it was also noted that the flammability, toxicity, efficiency, and cost of R-245ca and/or Blends are unresolved.

24028 (GKSS–94/E/60) **The GKSS test procedure for determining the fracture behaviour of materials: EFAM GTP 94.** Schwalbe, K.H. (GKSS-Forschungszentrum Geesthacht GmbH (Germany). Inst. fuer Werkstofforschung); Neale, B.K.; Heerens, J. GKSS-Forschungszentrum Geesthacht GmbH (Germnay). 1994. 111p. Order Number DE95777844. Source: OSTI; NTIS (US Sales Only).

This document describes a unified fracture mechanics test method in procedural form for quasi-static testing of materials. It is based on the ESIS Procedures P1 and P2 and introduces additional features, such as the δ_5 crack tip opening displacement, centre cracked tensile specimens, shallow cracks, "non-valid" CT and SENB specimen configurations, testing of weldments, and guidance for statistical treatment of scattered data. (orig.)

24029 (UCRL-ID–120930) **Terminal ballistic experiments for the development of turbine engine blade containment technology.** Gogolewski, R.P.; Cunningham, B.J. Lawrence Livermore National Lab., CA (United States). 25 Jan 1995. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014164. Source: OSTI; NTIS; GPO Dep.

The ballistic experiments reported herein were conducted in three sets between October 1993 and November 1994. The first set of experiments examined the ballistic failure of annealed titanium plates. These experiments were performed in a manner consistent with earlier experiments conducted at United Technologies' Pratt and Whitney Division. The second set of experiments examined the ballistic performance of select aluminum and titanium alloys in single-plate and laminate form. In both sets of experiments, the failure modes of the targets were observed and catalogued. The third set of experiments evaluated underlying issues associated with geometric scaling. Blunt .30-and .50-caliber hard steel projectiles impacted on geometrically similar annealed titanium plates.

4210 Combustion Systems

Refer also to citation(s) 23035, 23036, 23037, 23038, 23039, 23753, 23974

24030 (CONF-9504161–2) **Controlling cycle-by-cycle variation in a pulse combustor.** Daw, C.S. (Oak Ridge National Lab., TN (United States)); Thomas, J.F.; Rhode, M.A.; Rollins, R.W.; Markworth, A.J. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States);Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC05-84OR21400. Contract RP2426-25. From Central States/Western States Institute and American Flame Research committee meeting; San Antonio, TX (United States); 23-26 Apr 1995. Order Number DE95013209. Source: OSTI; NTIS; GPO Dep.

We describe a method for controlling chaos-generated cyclic variations in a pulse combustor. The method is applied to a recently developed thermal pulse combustor model and utilizes a map-based, adaptive proportional feedback algorithm. With this technique we show that it is possible to greatly reduce cycle-by-cycle pulse variation. We further show that minimizing cyclic variation allows combustor operation at conditions well beyond the normal flameout limit.

24031 (SAND–95-0008C) **Computational analysis of a three-dimensional High-Velocity Oxygen-Fuel (HVOF) Thermal Spray torch.** Hassan, B.; Lopez, A.R.; Oberkampf, W.L. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9509182–2: 1995 National thermal spray conference, Houston, TX (United States), 11-15 Sep 1995). Order Number DE95014994. Source: OSTI; NTIS; GPO Dep.

An analysis of a High-Velocity Oxygen-Fuel Thermal Spray torch is presented using computational fluid dynamics (CFD). Three-dimensional CFD results are presented for a curved aircap used for coating interior surfaces such as engine cylinder bores. The device analyzed is similar to the Metco Diamond Jet Rotating Wire torch, but wire feed is not simulated. To the authors' knowledge, these are the first published 3-D results of a thermal spray device. The feed gases are injected through an axisymmetric nozzle into the curved aircap. Argon is injected through the center of the nozzle. Pre-mixed propylene and oxygen are introduced from an annulus in the nozzle, while cooling air is injected between the nozzle and the interior wall of the aircap. The combustion process is modeled assuming instantaneous chemistry. A standard, two-equation, K-ε turbulence model is employed for the turbulent flow field. An implicit, iterative, finite volume numerical technique is used to solve the coupled conservation of mass, momentum, and energy equations for the gas in a sequential manner. Flow fields inside and outside the aircap are presented and discussed.

4250 Power Cycles

Refer also to citation(s) 23760

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 23923, 23933, 24008, 24011, 24018, 24390, 24394, 24429, 24430, 24431, 24835, 24857, 24879, 24994

24032 (CONF-940702–1) **Measured and predicted cold load pickup and feeder parameter determination using the harmonic model algorithm.** Law, J. (Idaho Univ., Moscow, ID (United States)); Elliott, L.; Minford, D.; Storms, M. Idaho Univ., Moscow, ID (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-92BP27938. From 1994 Institute of Electrical and Electronic Engineers/Power Engineering Society (IEEE/PES) summer meeting; San Francisco, CA (United States); 24-28 Jul 1994. Order Number DE95013069. Source: OSTI; NTIS; GPO Dep.

This paper presents theory of the "Cold Load Harmonic",CLHARM, model algorithm for simulation of power feeder currents resulting from both Cold Load STEPV method is also presented. Feeder parameters obtained from field STEPV measurement are used to predict CLPU on that feeder using the CHARM algorithm. STEPV test the same feeder are compared with computer predictions. The CLHARM aggregates feeder theormostatically controlled load to simulate regain of diversity during outage restoration. All feeder weather sensitive load is lumped in CLHARM, using mean parameter values of a simple theormodynamic model. The ultimate objective of this work is experimentally obtained feeder "signatures" for CLPU prediction as a feeder design tool.

24033 (CONF-951073–5) **A CMOS integrated circuit for pulse-shaped discrimination.** Frank, S.S.; Ericson, M.N.; Simpson, M.L.; Todd, R.A.; Hutchinson, D.P. Oak Ridge National Lab., TN (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From IEEE nuclear science symposium and medical imaging conference; San Francisco, CA (United States); 21-28 Oct 1995. Order Number DE95012877. Source: OSTI; NTIS; GPO Dep.

A CMOS integrated circuit (IC) for pulse-shape discrimination (PSD) has been developed. The IC performs discrimination of gamma-rays and neutrons as part of a system monitoring stored nuclear materials. The method implemented extracts the pulse tail decay time constant using a leading edge trigger for identifying the start of the pulse and a constant fraction discriminator (CFD) to determine the zero crossing of the shaped signal. The circuit is designed to interface with two photomultiplier tubes – one for pulse processing and one for coincidence detection. Two Outputs from the IC, a start and stop, can be used with a high speed timing system for pulse characterization with minimal external control. The circuit was fabricated in Orbit 1.2μm CMOS and operates from a 5-V supply. Specifics of the design including overall topology, charge sensitive preamplifier and CFD characteristics, shaping method and time constant selections, system timing, and implementation are discussed. Circuit performance is presented including dynamic range, timing walk, system dead time, and power consumption.

24034 (DOE/AL/98817–3) **Third quarterly report for TRP Flip Chip Attach.** International Business Machines Corp., Endicott, NY (United States). 25 Jul 1995. 45p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract FC04-94AL98817. Order Number DE95015512. Source: OSTI; NTIS; GPO Dep.

This report contains two separate reports for the Flip Chip Attach project. The first report is Yorktown's report as per their deliverable 1.6 on the rheological properties of the material. Since the paste dispensing process is preformed at shear rates above 100/s and in the low Reynolds's number, i.e., creeping flow regime, the authors have designed viscometry measurements to simulate the response under these conditions. The study determines simple parameters and criteria to obtain paste properties that may achieve high resolution dispensing. They compare and contrast their material with "the best in the business". They set forth a criteria for optimum screenability and demonstrate the high resolution dispensability of Yorktown pastes. Three Yorktown and two of the best commercial pastes are reported in this study. The second report documents a designed screening experiment to identify significant bonding variables. The bonding experiments were performed with the electrically conductive adhesive paste developed by Ravi, Saraf, and Sambucetti of the IBM Research Center at Yorktown Heights, NY. Eight bonding variables were incorporated in a two level factorial design with 16 trials. Palladium-nickel alloy plated copper coupons were used to simulate chips and substrates for this investigation. The shear tested chips were examined for fracture appearance characteristics. Only 11 of 46 chips displayed 50% or greater cohesive fracture. The most significant variables have been identified as bond pressure, temperature, and dwell time.

24035 (DOE/ER/45278–4) **[Structure and electronic properties of defects at nonlattice matched III-V semiconductor interfaces]. Progress report, 1989–90.** Ast, D.G. Cornell Univ., Ithaca, NY (United States). [1990]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER45278. Order Number DE95013303. Source: OSTI; NTIS; GPO Dep.

Research focused on control of misfit dislocations in strained epitaxial layers of GaAs through prepatterning of the substrate. Patterning and etching trenches into GaAs substrates before epitaxial growth results in nonplanar wafer surface, which makes device fabrication more difficult. Selective ion damaging the substrate prior to growth was investigated. The question of whether the overlayer must or must not be discontinuous was addressed. The third research direction was to extend results from molecular beam epitaxially grown material to organometallic chemical vapor deposition. Effort was increased to study the patterning processes and the damage it introduces into the substrate. The research program was initiated after the discovery that 500-eV dry etching in GaAs damages the substrate much deeper than the ion range.

24036 (DOE/R7/01314–T7) **Novel method for making semiconductor chips. Seventh quarterly and final report, January 7, 1995–May 7, 1995.** Welch (James D.), Omaha, NE (United States). [1995]. 291p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG47-93R701314. Order Number DE95014927. Source: OSTI; NTIS; GPO Dep.

Work under DOE Grant No. DE-FG47-93R701314, to investigate a Novel Process for Fabricating MOSFET Devices, has progressed to a point where feasibility of producing MOSFETS using Chromium Disilicide Schottky barrier junctions at Source and Drain has been shown. Devices fabricated, however, show inconsistent operating characteristics from device to device, and further work is required to overcome the defects. Some fabrication procedures have produced a relatively high, (e.g., ninety-five (95%) percent), yield of devices on a substrate which show at least some transistor action, while others have resulted in very low yield, (e.g., five (5%) percent). Consistency of results from device to device is less than desired. However, considering that the University of Nebraska at Lincoln (UNL) Electrical Engineering Fabrication Lab is not what industry can provide, it is reasonable to project that essentially one-hundred (99.99+%) percent yield should be achievable in an industrial setting because of the simplicity in the fabrication procedure.

24037 (LA–12901-PR) **AGEX II: Technical quarterly, Volume 2.** Ekdahl, C. (comp.). Los Alamos National Lab., NM (United States). Mar 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012120. Source: OSTI; NTIS; GPO Dep.

The AGEX II Technical Quarterly publishes short technical contributions on above ground experiments that use pulsed power and laser drivers. The Quarterly is intended to provide rapid exposure of timely technical ideas and results as well as a means for documenting AGEX II progress and scientific quality for the AGEX II community. Suitable topics include experimental results, diagnostic apparatus, theoretical design, and scaling, among others.

24038 (LBL-PUB–754, pp. 101-115) **Harmonic generation with multiple wiggler schemes.** Bonifacio, R. (Universita degli Studi, Milano (Italy)); De Salvo, L.; Pierini, P. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper the authors give a simple theoretical description of the basic physics of the single pass high gain free electron laser (FEL), describing in some detail the FEL bunching properties and the harmonic generation technique with a multiple-wiggler scheme or a high gain optical klystron configuration.

24039 (LBL-PUB–754, pp. 183-190) **Powerful electrostatic FEL: Regime of operation, recovery of the spent electron beam and high voltage generator.** Boscolo, I. (Univ. and INFN, Milan (Italy)); Gong, J. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

FEL, driven by a Cockcroft-Walton electrostatic accelerator with the recovery of the spent electron beam, is proposed as powerful radiation source for plasma heating. The low gain and high gain regimes are compared in view of the recovery problem and the high gain regime is shown to be much more favourable. A new design of the onion Cockcroft-Walton is presented.

24040 (LNF-IR–95-014) **KLOE data acquisition system: Addendum to KLOE technical proposal.** KLOE Collaboration. KLOE Collaboration. Apr 1995. 58p. Order Number DE95789749. Source: OSTI; NTIS (US Sales Only).

The report presents the desing of the KLOE data acquisition system and includes the philosophy and extensive discussions on all parts of the system.

24041 (SAND–94-2593C) **Effects of pre-stressing and flux on the flow of solder on PWB copper surfaces.** Hernandez, C.L.; Hosking, F.M. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506182–2: NEPCON East '95, Boston, MA (United States), 12-15 Jun 1995). Order Number DE95011599. Source: OSTI; NTIS; GPO Dep.

A variety of test methods are available to evaluate the solderability of printed wiring board [PWB] surface finishes. A new test has been developed which better simulates the capillary flow physics of typical solder assembly processing, especially surface mount soldering. The work was conducted under a cooperative research and development agreement between Sandia National Laboratories, the National Center for Manufacturing Sciences, and several PWB fabricators (AT&T, IBM, Texas Instruments, and United Technologies Corporation/Hamilton Standard) to advance PWB interconnect systems technology. Particular attention has been given at Sandia to characterizing the effects of accelerated aging in a simulated indoor industrial environment on subsequent PWB solderability. The program's baseline surface finish was copper. Solderability testing on "as-fabricated" and "pre-stressed copper" pad-strip geometries was performed with Sn-Pb eutectic solder and three different fluxes at four different reflow temperatures.

24042 (SAND–95-0913) **An optically-triggered semiconductor switch for high power laser beams.** Chow, Weng W.; Warren, M.E. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013885. Source: OSTI; NTIS; GPO Dep.

The work involves research leading to an optically triggered switch for a high power laser pulse. The switch uses a semiconductor heterostructure whose optical properties are modified by a low power laser trigger such as a laser diode. Potential applications include optical control of pulsed power systems, control of medical lasers and implementation of security features in optical warhead architectures.

24043 (SAND–95-1040) **A one piece wall box for space electronics.** Greenwood, W.H. Sandia National Labs., Albuquerque, NM (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014490. Source: OSTI; NTIS; GPO Dep.

In extraterrestrial applications, satellite payloads have printed circuit modules that are housed in boxes or chassis. The box may be a one piece wall or a segmented wall. These two wall options are compared for function and cost.

24044 (SAND–95-1165C) **Transformer design considerations for non-continuous mode, boost, flyback converters.** Nagel, R. Sandia National Labs., Albuquerque, NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950987–1: Electrical/electronics insulation conference, Chicago, IL (United States), 18-21 Sep 1995). Order Number DE95013830. Source: OSTI; NTIS; GPO Dep.

This paper presents some design considerations for small, flyback transformers used to charge energy storage capacitors to 0.1 to 5 KV from a low voltage DC source.

24045 (SAND–95-1374C) **$La_{0.5}Sr_{0.5}CoO_3$ electrode technology for Pb(Zr, Ti)O_3 thin film nonvolatile memories.** Tuttle, B.A.; Al-Shareef, H.N.; Warren, W.L.; Raymond, M.V.; Headley, T.J.; Voigt, J.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950728–1: 1. European meeting on integrated ferroelectricity, Nijmegen (Netherlands), 4-8 Jul 1995). Order Number DE95014863. Source: OSTI; NTIS; GPO Dep.

Oxide electrode technology is investigated for optimization of Pb(Zr,Ti)O_3 (PZT) thin film capacitor properties for high density nonvolatile memory applications. PZT thin film capacitors with RF sputter deposited $La_{0.5}Sr_{0.5}CoO_3$ (LSCO) electrodes have been characterized with respect to the following parameters: initial dielectric hysteresis loop characteristics, fatigue performance, microstructure and imprint behavior. Our studies have determined that the fatigue of PZT capacitors with LSCO electrodes is less sensitive to B site cation ratio and underlying electrode stack technology than with RuO_2 electrodes. Doping PZT thin films with Nb (PNZT) improves imprint behavior of LSCO//PZT//LSCO capacitors considerably. We have demonstrated that PNZT 4/30/70 //LSCO capacitors thermally processed at either 550°C or 675°C have almost identical initial hysteresis properties and exhibit essentially no fatigue out to approximately 10^{10} cycles.

24046 (SAND–95-1425C) **Composition analysis of ECR-grown SiO_2 and SiO_xF_y films.** Burkhart, J.H. (Idaho State Univ., Pocatello, ID (United States)); Denison, D.; Barbour, J.C.; Apblett, C.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9505122–1: International conference on ion beam analysis, Tempe, AZ (United States), 22-26 May 1995). Order Number DE95014860. Source: OSTI; NTIS; GPO Dep.

The Office of integrated Analysis and Forecasting (OIAF) is required to provide complete model documentation to meet the EIA Model Acceptance Standards. The Model Documentation for the Electricity Market Module (EMM) provides a complete description of the EMM methodology, structure, and relation to other modules in the National Energy Modeling System (NEMS). This Model Developers Report (MDR) serves as an appendix to the methodology documentation. The MDR provides an assessment of the sensitivity of the EMM results to changes in input data or parameters.

24047 (SAND–95-8550C) **Extreme Ultraviolet Lithography with laser plasma sources.** Kubiak, G.D.; Tichenor, D.A.; Stulen, R.H. Sandia National Labs., Livermore, CA (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9507122–2: CLEO/Pacific Rim coal conference, Makuhar (Japan), 11-14 Jul 1995). Order Number DE95010753. Source: OSTI; NTIS; GPO Dep.

Extreme Ultraviolet Lithography (EUVL) is being developed for the fabrication of integrated circuits having dimensions of $\leq$ 0.13 μm. The development and use of high-power, low-debris laser-produced plasma sources of 11–14 nm radiation for this application will be described.

24048 (UCRL-ID–118502) **Small-business technology transfer program, case number 93119 - second harmonic generation for Lee Laser Inc.: Resonator designs.** Erbert, G.V.

Lawrence Livermore National Lab., CA (United States). 2 Sep 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015378. Source: OSTI; NTIS; GPO Dep.

The author has investigated several resonator designs for Lee Laser Inc. as outlined in the Short-Term Technical Assistance Project, case number 93119. The scope of this work was to identify various resonator options which would be suitable for use in an intra-cavity doubled Nd:YAG laser and compatible with Lee Laser hardware. This work consisted of computer modeling of laser resonators to identify mirror curvatures, distances, beam sizes, and sensitivity to thermal loading of the laser rod.

24049 (UCRL-ID–118749) **DEWPOINT. Final report.** Riddle, R.A. Lawrence Livermore National Lab., CA (United States). Sep 1994. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011758. Source: OSTI; NTIS; GPO Dep.

The DEWPOINT (Directed Energy POwer INTegration) program was aimed at providing the large amounts of electric power required for a laser or accelerator based in space, or on an aircraft or satellite platform. This is our final report on our efforts as a part of this program which was cancelled before completion. This report summarizes the entire scope of effort funded by this program. It also includes some related information on cryogenically cooled microchannel heatsinks which was funded internally by LLNL. Specifically, the DEWPOINT program was to provide the electrical power for the proposed Neutral Particle Beam weapon system of the Strategic Defense Initiative. The Neutral Particle Beam called for a space-based accelerator driven by radio frequency power sources. The radio frequency solid-state power amplifiers generate waste heat which must be dissipated.

24050 (UCRL-JC–117006) **Theory of recombination x-ray lasers based on optical-field ionization.** Eder, D.C. (Lawrence Livermore National Lab., CA (United States)); Amendt, P.; DaSilva, L.B.; London, R.A.; Rosen, M.D.; Wilks, S.C.; Donnelly, T.D.; Falcone, R.W. Lawrence Livermore National Lab., CA (United States). Dec 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940592–14: 4. international colloquium on X-ray lasers, Williamsburg, VA (United States), 16-20 May 1994). Order Number DE95015031. Source: OSTI; NTIS; GPO Dep.

Ultrashort-pulse, high-intensity laser drivers have the potential for creating tabletop-size x-ray lasers by ionizing the target gas via the electric field of the laser pulse. For appropriate plasma conditions following ionization, lasing can occur during the subsequent rapid recombination. A review of the theory and modeling for these optical-field-ionized x-ray lasers is presented. Particular attention is given to the issues of electron beating and ionization-induced refraction. We summarize modeling in support of experiments where evidence of lasing in H-like Li at 135 Å was obtained. In addition, we present modeling results for lasing in Li-like N at 247 Å. We briefly discuss new applications appropriate for tabletop-size high-repetition-rate x-ray lasers.

24051 (UCRL-JC–118120) **Laser properties of an improved average-power Nd-doped phosphate glass.** Payne, S.A. (and others); Marshall, C.D.; Bayramian, A.J. Lawrence Livermore National Lab., CA (United States). 15 Mar 1995. 11p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940723–43: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE95014366. Source: OSTI; NTIS; INIS; GPO Dep.

The Nd-doped phosphate laser glass described herein can withstand 2.3 times greater thermal loading without fracture, compared to APG-1 (commercially-available average-power glass from Schott Glass Technologies). The enhanced thermal loading capability is established on the basis of the intrinsic thermomechanical properties (expansion, conduction, fracture toughness, and Young's modulus), and by direct thermally-induced fracture experiments using Ar-ion laser heating of the samples. This Nd-doped phosphate glass (referred to as APG-t) is found to be characterized by a 29% lower gain cross section and a 25% longer low-concentration emission lifetime.

24052 (UCRL-JC–118186) **New diode wavelengths for pumping solid-state lasers.** Skidmore, J.A. (and others); Emanuel, M.A.; Beach, R.J. Lawrence Livermore National Lab., CA (United States). Jan 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950226–55: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95014684. Source: OSTI; NTIS; GPO Dep.

High-power laser-diode arrays have been demonstrated to be viable pump sources for solid-state lasers. The diode bars (fill factor of 0.7) were bonded to silicon microchannel heatsinks for high-average-power operation. Over 12 W of CW output power was achieved from a one cm AlGaInP tensile-strained single-quantum-well laser diode bar. At 690 nm, a compressively-strained single-quantum-well laser-diode array produced 360 W/cm^2 per emitting aperture under CW operation, and 2.85 kW of pulsed power from a 3.8 cm^2 emitting-aperture array. InGaAs strained single-quantum-well laser diodes emitting at 900 nm produced 2.8 kW pulsed power from a 4.4 cm^2 emitting-aperture array.

24053 (UCRL-JC–119257) **Applications of microlens-conditioned laser diode arrays.** Beach, R.J. (and others); Emanuel, M.A.; Freitas, B.L. Lawrence Livermore National Lab., CA (United States). Jan 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950226–53: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95014158. Source: OSTI; NTIS; GPO Dep.

The ability to condition the radiance of laser diodes using shaped-fiber cylindrical-microlens technology has dramatically increased the number of applications that can be practically engaged by diode laser arrays. Lawrence Livermore National Laboratory (LLNL) has actively pursued optical efficiency and engineering improvements in this technology in an effort to supply large radiance-conditioned laser diode array sources for its own internal programs. This effort has centered on the development of a modular integrated laser diode packaging technology with the goal of enabling the simple and flexible construction of high average power, high density, two-dimensional arrays with integrated cylindrical microlenses. Within LLNL, the principal applications of microlens-conditioned laser diode arrays are as high intensity pump sources for diode pumped solid state lasers (DPSSLs). A simple end-pumping architecture has been developed and demonstrated that allows the radiation from microlens-conditioned, two-dimensional diode array apertures to be efficiently delivered to the end of rod lasers. To date, pump powers as high as 2.5 kW have been delivered to 3 mm diameter laser rods. Such high power levels are critical for pumping solid state lasers in which the terminal laser level is a Stark level lying in the ground state manifold. Previously, such systems have often required operation of the solid state gain medium at low temperature to freeze out the terminal laser Stark level population. The authors recently developed high intensity pump sources overcome this difficulty by effectively pumping to much higher inversion levels, allowing efficient operation at or near room temperature. Because the end-pumping technology is scalable in absolute power, the number of rare-earth ions and transitions that can be effectively accessed for use in practical DPSSL systems has grown tremendously.

24054 (UCRL-JC–119611) **Amplification of femtosecond pulses to above 1 J with large aperture Cr:LiSrAlF$_6$ amplifiers.** Ditmire, T.; Perry, M.D. Lawrence Livermore National Lab., CA (United States). Jan 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950226–54: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95014678. Source: OSTI; NTIS; GPO Dep.

The authors have developed a chirped pulse amplification system capable of producing femtosecond pulses with energy above

one joule. This is accomplished by using a large aperture, flashlamp pumped Cr-LiSrAlF$_6$ (Cr:LiSAF) amplifier. Optimum design of the 19 mm diameter amplifier results in a single pass gain of 5 with good beam quality. This amplifier produces 1.05 J pulses after compression with a width of < 125 fs at a repetition rate of 0.05 Hz.

24055 (UCRL-JC–119626) **EUV lithography cost of ownership analysis.** Hawryluk, A.M.; Ceglio, N.M. Lawrence Livermore National Lab., CA (United States). 19 Jan 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409177–9: Optical Society of America conference on extreme ultraviolet lithography, Monterey, CA (United States), 19-21 Sep 1994). Order Number DE95014675. Source: OSTI; NTIS; GPO Dep.

The cost of fabricating state-of-the-art integrated circuits (ICs) has been increasing and it will likely be economic rather than technical factors that ultimately limit the progress of ICs toward smaller devices. It is estimated that lithography currently accounts for approximately one-third the total cost of fabricating modern ICs([1]). It is expected that this factor will be fairly stable for the forseeable future, and as a result, any lithographic process must be cost-effective before it can be considered for production. Additionally, the capital equipment cost for a new fabrication facility is growing at an exponential rate (2); it will soon require a multibillion dollar investment in capital equipment alone to build a manufacturing facility. In this regard, it is vital that any advanced lithography candidate justify itself on the basis of cost effectiveness. EUV lithography is no exception and close attention to issues of wafer fabrication costs have been a hallmark of its early history. To date, two prior cost analyses have been conducted for EUV lithography (formerly called "Soft X-ray Projection Lithography"). The analysis by Ceglio, et. al., provided a preliminary system design, set performance specifications and identified critical technical issues for cost control. A follow-on analysis by Early, et.al., studied the impact of issues such as step time, stepper overhead, tool utilization, escalating photoresist costs and limited reticle usage on wafer exposure costs. This current study provides updated system designs and specifications and their impact on wafer exposure costs. In addition, it takes a first cut at a preliminary schematic of an EUVL fabrication facility along with an estimate of the capital equipment costs for such a facility.

24056 (UCRL-JC–119629) **Coating strategy for enhancing illumination uniformity in a lithographic condenser.** Gaines, D.P.; Vernon, S.P.; Sommargren, G.E.; Kania, D.R. Lawrence Livermore National Lab., CA (United States). 26 Jan 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409177–8: Optical Society of America conference on extreme ultraviolet lithography, Monterey, CA (United States), 19-21 Sep 1994). Order Number DE95014371. Source: OSTI; NTIS; INIS; GPO Dep.

A three-element Koehler condenser system has been fabricated, characterized, and integrated into an EUV lithographic system. The multilayer coatings deposited on the optics were designed to provide optimal radiation transport efficiency and illumination uniformity. Extensive EUV characterization measurements performed on the individual optics and follow-on system measurements indicated that the condenser was operating close to design goals. Multilayer d-spacings were within 0.05 nm of specifications, and reflectances were approximately 60%. Illumination uniformity was better than ±10%. The broadband transport efficiency was 11%.

24057 (UCRL-JC–119634) **Critical illumination condenser for extreme ultraviolet projection lithography.** Cohen, S.J.; Seppala, L.G. Lawrence Livermore National Lab., CA (United States). 2 Mar 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409177–16: Optical Society of America conference on extreme ultraviolet lithography, Monterey, CA (United States), 19-21 Sep 1994). Order Number DE95014683. Source: OSTI; NTIS; GPO Dep.

A condenser system couples a radiation source to an imaging system. The authors have designed a critical illumination condenser system which meets the technical challenges of extreme ultraviolet projection lithography based on a ring field imaging system and a laser produced plasma source. The optical system, a three spherical mirror optical design, is capable of illuminating the extent of the mask plane by scanning either the primary mirror or the laser plasma source. This type of condenser optical design is sufficiently versatile to be employed with two distinct systems, one from Lawrence Livermore National Laboratory and one from AT and T/Sandia.

24058 (UCRL-JC–119725) **Copper electroplating process for sub-half-micron ULSI structures.** Contolini, R.J. (Lawrence Livermore National Lab., CA (United States)); Tarte, L.; Graff, R.T.; Evans, L.B.; Cox, J.N.; Puich, M.R.; Gee, J.D.; Mu, Xiao-Chun; Chiang, Chien. Lawrence Livermore National Lab., CA (United States). 15 May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506206–1: Very large scale integration multilevel interconnection conference, Santa Clara, CA (United States), 27-28 Jun 1995). Order Number DE95014674. Source: OSTI; NTIS; GPO Dep.

We have utilized electroplating technology in a damascene process to produce low resistance copper interconnects in sub-half-micron ULSI patterns having aspect ratios of 2.4:1. The use of a pulsed-voltage plating technique allows trench filling capability without voids. Samples of 150 mm diameter were patterned and sputtered with a barrier layer, followed by a copper seed layer. Pulsed-voltage electroplating, deposited about 2 microns of copper uniformly (1 sigma < 5%) over the surface. The electroplated copper has low levels of impurities, excellent adhesion, excellent step coverage, and rates comparable to other deposition methods. We present details of the electroplating equipment, and data on the filling characteristics of the copper metallization which prevent void formation and reduce contact resistance.

43 PARTICLE ACCELERATORS

Refer also to citation(s) 24773

24059 (BNL–61553) **Research by industry at the National Synchrotron Light Source.** Brookhaven National Lab., Upton, NY (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95014519. Source: OSTI; NTIS; INIS; GPO Dep.

The world's foremost facility for research using x-rays and ultraviolet and infrared radiation, is operated by the National Synchrotron Light Source dept. This pamphlet described the participating research teams that built most of the beam lines, various techniques for studying materials, treatment of materials, and various industrial research (catalysis, pharmaceuticals, etc.).

24060 (INIS-JP–037) **Proceedings of the 9th symposium on accelerator science and technology.** National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). 1994. 509p. (CONF-9308270–: 9. symposium on accelerator science and technology, Tsukuba (Japan), 25-27 Aug 1993). Order Number DE95789433. Source: OSTI; NTIS; INIS.

This issue is the collection of the papers presented at the title conference. The 163 of the presented papers are indexed individually. (J.P.N.).

4301 Design, Development, and Operation

Refer also to citation(s) 23833, 24779, 24780, 24886, 24915

24061 (ANL/ASD/CP–85045) **Commissioning software tools at the Advanced Photon Source.** Emery, L. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–233: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013751. Source: OSTI; NTIS; INIS; GPO Dep.

A software tool-oriented approach has been adopted in the commissioning of the Advanced Photon Source (APS) at Argonne National Laboratory, particularly in the commissioning of the Positron Accumulator Ring (PAR). The general philosophy is to decompose a complicated procedure involving measurement, data processing, and control into a series of simpler steps, each accomplished by a generic toolkit program. The implementation is greatly facilitated by adopting the SDDS (self-describing data set protocol),

which comes with its own toolkit. The combined toolkit has made accelerator physics measurements easier. For instance, the measurement of the optical functions of the PAR and the beamlines connected to it have been largely automated. Complicated measurements are feasible with a combination of tools running independently.

24062 (ANL/ED/CP–86766) **A hard x-ray micro-analytical beamline at the CAMD synchrotron.** Petri, M.C. (Argonne National Lab., IL (United States)); Leibowitz, L.; Schilling, P. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950793–2: 40. annual meeting of the Society of Photo-Optical Instrumentation Engineers: international symposium on optical science, engineering and instrumentation, San Diego, CA (United States), 9-14 Jul 1995). Order Number DE95014232. Source: OSTI; NTIS; GPO Dep.

Argonne National Laboratory (ANL) is collaborating with Louisiana State University (LSU) in constructing a synchrotron x-ray micro-analytical beamline at the Center for Advanced Microstructures and Devices (CAMD) in Baton Rouge. This project grew from earlier work at the National Synchrotron Light Source (NSLS), where a team of ANL researchers developed techniques to examine small-scale structures in diffusion zones of a variety of materials. The ANL/CAMD beamline will use x-ray fluorescence, diffraction, and absorption spectroscopy techniques to reveal both compositional and structural information on a microscopic scale.

24063 (BNL–61222) **Alignment and survey of the elements in RHIC.** Trbojevic, D. (and others); Cameron, P.; Ganetis, G.L. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–128: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011804. Source: OSTI; NTIS; GPO Dep.

The Relativistic Heavy Ion Collider (RHIC) consists of two rings with cryogenic magnets at a 4.5K operating temperature. Control of positions of the dipole and quadrupole cold masses (iron laminations) and the beam position monitors (BPM's) during production and installation is presented. The roll of the dipoles is controlled by a combination of rotating coil measurements with the surveying measurements. The center of the quadrupole magnetic field is obtained by direct measurement of the field shape within a colloidal cell placed inside the quadrupoles. Special attention is given to the triplet quadrupole alignment and determination of the field center position.

24064 (BNL–61876) **Gas breakdown limits for inverse Cherenkov laser accelerators.** Liu, Y. (California Univ., Los Angeles, CA (United States). Dept. of Physics); Pogorelsky, I.V. Brookhaven National Lab., Upton, NY (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95015367. Source: OSTI; NTIS; INIS; GPO Dep.

The probability of avalanche, tunneling and multiphoton ionization induced by a CO_2 laser in H_2 gas has been calculated. Laser light screening by a self-induced plasma density gradient is considered as the limiting factor for upscaling a CO_2 laser-driven Inverse Cherenkov Laser Accelerator beyond 650 MeV/m. However, in near-resonance inverse Cherenkov acceleration where a shorter wavelength laser is used at a wavelength near the resonance of the gas (e.g. 248nm in H_2), the formation of a plasma is not a problem because the plasma density is below the critical density. In that case, the laser beam propagates unaffected through the plasma and the acceleration gradient is not limited by gas breakdown. Gradients > 1 GeV/m are possible.

24065 (DOE/EA–0848) **Construction and operation of a 10 MeV electron accelerator and associated experimental facilities at Brookhaven National Laboratory, Upton, New York. Environmental assessment.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Feb 1994. 20p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012128. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this environmental impact statement is to determine whether there would be significant environmental impacts associated with the construction of an experimental facility at Brookhaven National Laboratory for radiation chemistry research and operation of the 10-MeV electron accelerator proposed for it. The document describes the need for action, alternative actions, the affected environment, and potential environmental impacts.

24066 (JINR-D–9-92-455) **Proceedings of the 13. workshop on charged particle accelerators. Volume 1.** Vasil'ev, A.A. (ed.). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The present status of charged particle accelerators and storage rings is considered. The new acceleration techniques are described and possible ways of their realization are shown. A lot of papers are devoted to the consideration of two-beam ion acceleration method.

24067 (JINR-D–9-92-455, pp. 30-35) **25 years of operation of the LUEh-2000 Kharkov linac for physical programs.** Akchurin, Yu.I. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)); Beloglazov, V.I.; Biller, E.Z. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Present status of the LUEh-2000 Kharkov electron linac is described. Accelerator operated for different physical programs without modification and repair. Accelerator parameters were improved at the expanse of modification of separate systems. More than 100 thousand hours accelerator operated for experimental programs during the period from 1966. Electron beam parameters obtained in 1966 and 1990 are given. Aiming at the construction of the pulse-stretcher obtaining quasi continuous electron beams and developing polarized electron sources plans for the accelerator modifications are described. 5 refs., 2 tabs., 3 figs.

24068 (JINR-D–9-92-455, pp. 36-42) **Free electron laser for the 2 x 1 TeV photon collider.** Sarantsev, V.P. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Yurkov, M.V.; Saldin, E.L.; Shnejdmiller, E.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The two-cascade scheme of a free electron laser (FEL) of the 2 x 1 TeV photon collider is suggested. The FEL-generator having peak power of $\approx$ 10 MW which is amplified up to 5 x 10^{11} W in the FEL-amplifier with variable parameters is used as a driving laser. Requirements for parameters of electron beam and the FEL-amplifier magnetic system are formulated on the base of calculations. 19 refs., 2 tabs., 4 figs.

24069 (JINR-D–9-92-455, pp. 107-111) **Present status of the nuclotron.** Averichev, S.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Agapov, N.N.; Baldin, A.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Present status of the construction of the JINR nuclotron-synchrotron designed for acceleration of nuclei up to 6 GeV/nucleon is described. Nuclotron magnetic system test results are presented. The pressure in the accelerator vacuum chamber attained less than 10^{-9} Torr. The injection of 6 MeV/nucleon polarized deuteron beam having the intensity of 2 x 10^9 particles per pulse at the let of the ring have been performed. 4 refs., 1 tab., 2 figs.

24070 (JINR-D–9-92-455, pp. 118-121) **Modification of the UKP-2-1 heavy ion charge accelerator.** Arzumanov, A.A. (Akademiya Nauk Respubliki Kazakhstan, Inst Yadernoj fiziki,

Alma-Ata (Kazakhstan)); Borisenko, A.N.; Gorlachev, I.D.; Lysukhin, S.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the modification of the UKP-2-1 tandem heavy ion accelerator are presented. High-voltage power supply stability and improvement of the beam injection system are the main directions of modification. Experimental results of measuring thin films by means of resonance nuclear reactions and the study on proton beam channeling in tungsten monocrystal are given. 3 refs., 1 tab., 6 figs.

24071 (JINR-D--9-92-455, pp. 122-125) **Acceleration of heavy ion beams at the IYaF AN RK cyclotron.** Arzumanov, A.A. (Akademiya Nauk Respubliki Kazakhstan, Inst Yadernoj fiziki, Alma-Ata (Kazakhstan)); Batishchev, V.N.; Gerasimov, V.I.; Gor'kovets, M.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of experiments of heavy ion beams acceleration at the third harmonic of RF accelerating voltage in the isochronous cyclotron with energy coefficient of K = 50 and with application of the direct-heated Penning ion source having arc pulse supply and enhanced anode voltage are presented. Two-, three- and four-charge internal beams of carbon, nitrogen and oxygen ions having the intensity of 1 - 13 μA ion phase motion and the formation of acceleration regimes to provide optimal extraction of ions are considered. 5 refs., 3 figs.

24072 (JINR-D--9-92-455, pp. 126-130) **Adjustment of the UK - auxiliary magnetic ring of the ITEP accelerating complex.** Alekseev, N.N. (Inst Teoreticheskoj i Ehksperimental'noj Fiziki, Moscow (Russian Federation)); Bol'shakov, A.E.; Gaponenko, S.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of alignment and testing an auxiliary magnetic ring (MR) which is a booster synchrotron for the ITEP U-10 proton synchrotron are presented. The MR structure has 21 period. Each period has a six-meter rectilinear gap. Experiments with circulating beam showed the possibility of obtaining circulating beam current of several tens of μA in the vicinity of operation point. 1 ref., 1 tab., 3 figs.

24073 (JINR-D--9-92-455, pp. 134-141) **Project of a heavy accelerating complex.** Kukhtin, V.P. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Kozienko, M.T.; Lamzin, E.A.; Rozhdestvenskij, B.V.; Severgin, Yu.P.; Smirnov, Yu.V.; Solames, A.A.; Shukejlo, I.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

An accelerating complex based on two cyclotrons and the Ecr-ion source designed for the production of 6.5 MeV/nucleon heavy ions (which is equivalent to Coulomb barrier) is suggested. Comparatively small size, weight and power supply are attained at the expense of specific energy gain at the outlet in spite of the type of accelerated particles. Accelerating complex is an individual module and may be used in the structure with large accelerating accelerating complexes like Moscow Meson Factory, TRIUMF (Canada) and so on. The given accelerating complex may be used for the acceleration of both radioactive and stable ions. 2 tabs., 6 figs.

24074 (JINR-D--9-92-455, pp. 147-149) **Status of construction of the Kurchatov institute MGTs-10 small-sized cyclotron.** Burbeza, K.D. (Rossijskij Nauchnyj Tsentr 'Kurchatovskij Inst', Moscow (Russian Federation)); Vasil'ev, A.A.; Venikov, N.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Status of the construction of the MGTs-10 isochronous cyclotron designed for joint operation with a positron emission-tomography center and for the production of ^{11}C, ^{13}N, ^{15}O and ^{18}F ultrashort-lived radionuclides is described. The greater part of magnetic system elements have been manufactured and the on-line system designed for magnetic field measurement has been constructed. Cyclotron vacuum chamber tests have been performed. 3 figs., 2 figs.

24075 (JINR-D--9-92-455, pp. 156-160) **Electrodynamic characteristics of accelerating structure of the Moscow meson factory radionuclide linear accelerator (LURAN).** Bomko, B.A. (UNTs Khar'kovskogo Fiziko-Tekhnicheskogo Instituta, Kharkov (Ukraine)); D'yachenko, A.F.; Kobets, A.F.; Rudyak, B.I.; Vyalov, G.N.; Ostroumov, P.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Calculation results and experimental study on electrodynamic characteristics of the continuous action linear accelerator designed for the production, separation and post acceleration of radionuclides for the Moscow Meson Factory are presented. Investigations have been performed at the functional model of a 5-sectional rod-loaded mass-to-charge ratio of ions accelerating structure with initial equalling to 60. 2 refs., 4 figs.

24076 (JINR-D--9-92-455, pp. 161-163) **Method of radioactive nuclei acceleration using one accelerator.** Dem'yanov, A.V. (Akademiya Nauk Ukrainy, Inst Yadernykh Issledovanij, Kiev (Ukraine)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The scheme designed for acceleration of radioactive nuclei using one accelerator is suggested. The scheme comprises the following main elements: an external multicharged ion source of nonradiative atoms, a beam bending magnet, an ion axial injection system, a heavy ion accelerator, an electrostatic analyzer, an external injector of high-charge separated ions of radioactive atoms, a magnetic separator and a bending magnet for beam injection into an accelerator. 2 refs., 2 figs.

24077 (JINR-D--9-92-455, pp. 164-166) **Multicharged ion beam production with a narrow energy spectra in the regime of particle final energy variation.** Kolyaskin, A.D. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (Russian Federation)); Val'dner, O.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The possibility of the production of charged particle accelerated beams with a narrow energy spectra at the tandem - RF linear multi sectional post accelerator complexes is investigated. It is shown, that this problem can be solved using beam emittance matching with a longitudinal acceptance of a post accelerator channel. 1 ref., 1 tab., 1 fig.

24078 (JINR-D--9-92-455, pp. 167-169) **On possibility of ion acceleration in synchrotrons at RF electric field permanent**

frequency. Belov, V.P. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Severgin, Yu.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The method of ion acceleration up to the energy of > 100 MeV/m at the RF electric field constant frequency in the synchrotrons is suggested. In the given method, ion acceleration is provided at high repetition rate and the RF field constant frequency and RF voltage changes according to the law of particles arriving to the new neighbouring separatrix every each cycle. Thus, higher repetition rate of acceleration is attained, no frequency tuning is required and the RF-stations have small overall dimensions. 1 ref.

24079 (JINR-D--9-92-455, pp. 187-190) **Experience of operation with normal-conducting accelerating structures in the continuous-wave mode.** Alimov, A.S. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Ishkhanov, B.S.; Piskarev, I.M.; Sakharov, V.P.; Tiunov, A.V.; Shvedunov, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The construction of the 175 MeV continuous action racetrack microtron with average beam current of 100 μA is under way at the Institute for Nuclear Physics of the Moscow University. The main accelerator components have been produced. Physical start up of the injector designed for the energy of 6.2 MeV and maximum beam current of 1 mA was performed. The biperiodic accelerating structure with internal coupling cells is used in the linear accelerator. 1 tab., 3 figs.

24080 (JINR-D--9-92-455, pp. 191-194) **Methods of minimization of frequency shift in accelerating structures at power input into an accelerator.** Tiunov, A.V. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Shvedunov, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Two methods of the frequency shift in accelerating structures with internal coupling cells at a power input into the accelerator are considered. High distributed cooling system is used in the first method. The purposeful variation of the deformation character of the structure at the expense of using bimetallic structures on the base of copper and molybdenum is used in the second method. 4 refs., 1 tab., 1 fig.

24081 (JINR-D--9-92-455, pp. 258-260) **On potential distribution in accelerating structure with RF-quadrupole focusing.** Lymar', A.G. (UNTs Khar'kovskogo Fiziko-Tekhnicheskogo Instituta, Kharkov (Ukraine)); Martynenko, P.A.; Khizhnyak, N.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the calculation of electric potential distribution between electrodes of an accelerating system, which is drift tubes arranged in the form of match boxes are presented. Three-dimensional Laplace equation solved by the finite-difference method has been used in the calculations. 6 refs., 1 fig.

24082 (JINR-D--9-92-455, pp. 261-264) **Acoustic effects in accelerator electrodynamic structures.** Kapyrin, Yu.V. (Rossijskij Nauchnyj Tsentr 'Kurchatovskij Institut', Moscow (Russian Federation)); Moiseev, V.I.; Petrenko, V.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The relationship between efficiencies of ponderomotive and thermoelasticity nonlinear mechanisms of ultrasound excitation by a pulse electromagnetic microwave field is determined. Electromagnetic field -acoustic field coupling due to the strong external magnetic field in conducting structures is considered. The effect of skin layer acoustic motion on the surface impedance of metallic walls of electrodynamic structures is investigated. 3 refs.

24083 (JINR-D--9-92-455, pp. 274-276) **RF-power recuperation system of the final part of Kharkov large accelerator for material sciences.** Lobzov, L.D. (UNTs Khar'kovskogo Fiziko-Tekhnicheskogo Instituta, Kharkov (Ukraine)); Mazalov, Yu.P.; Khizhnyak, N.A.; Shulika, N.G.; Grebenyuk, S.V.; Prudkij, V.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The description of the RF power recuperation system of the output of the ion accelerator designed for material sciences is presented. The scheme of a travelling wave resonator with recuperation chains is given. The basic element of the resonator ring is a tunable coupler. The resonator ring comprises elements of tuning and control of resonator parameter mode. Movable short-circuit stubs provide the reflection compensation in the resonator. The major parameters of the resonator are presented. 5 refs., 1 tab., 1 fig.

24084 (JINR-D--9-92-455, pp. 282-284) **Hybrid plasma slowing-down structures for linear accelerators.** Karbushev, N.I. (Moskovskij Radiotekhnicheskij Inst, Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The possibility of the improvement of linear accelerator characteristics by means of a high-frequency slowing-down structure channel filling with a plasma is considered. The presence of a plasma may lead to the increase of electric field wave longitudinal component amplitude and the following increase of maximum accelerating rate is shown. 19 refs., 2 figs.

24085 (JINR-D--9-92-455, pp. 285-288) **Protection gas gaps testing and calculation of breakdown voltage of accelerator inner structures.** Rezvykh, K.A. (Fiziko-Ehnergeticheskij Inst, Obninsk (Russian Federation)); Romanov, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Test results of discharge gaps of the Eh G-2.5 high-voltage accelerator in N_2 - CO_2, C Cl_2 F_2 and S F_6 gases are presented. The technique of calculation of breakdown voltage for the 3 - 4 mm gaps is suggested. The technique allows to estimate the electric strength of hundreds of internal gaps with parallel connection and the reliability of operating and developing accelerators, as well. The calculation accuracy is $\pm$ 5%. 7 refs.

24086 (JINR-D--9-92-455, pp. 409-412) **Submillimeter wave range parametric free-electron laser.** Alekseev, V.I.; Belovintsev, K.A.; Bessonov, E.G.; Kol'tsov, A.V.; Serov, A.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224--: 13. national particle accelerator

conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The experimental facility based on a parametric free-electron laser designed for generating and investigating submillimeter wave range spontaneous and induced ondulator radiation is developed. The 7 MeV microtron with designed average pulse current of 70 mA is a relativistic electron source. Radiation generation occurs during beam passage through ondulator spatial-periodic magnetic field. 3 refs., 3 figs.

24087 (JINR-D–9-92-455, pp. 455-459) **Proposal on construction of high-current racetrack accelerator as an electron injector for a multipurpose breeding target.** Aleksakhin, Yu.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Molodozhentsev, A.Yu.; Sidorov, A.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The possibility of construction of a high-resolution neutron source (HRNS) comprising the Ibr - 30 reactor and a racetrack induction electron linac is investigated. It is shown that HRNS thermal neutron flux quality will be comparable with the Ibr - 2 neutron flux at the reactor power less by a factor of 40. The given linac can be used for the production of a power positron flux which will permit to increase the positron acceleration rate at the VEPP - 4 type colliders. 3 refs., 3 figs.

24088 (JINR-D–9-92-455, pp. 467-470) **Rig for study on ion dynamics in RF quadrupole focusing accelerating.** Belikov, V.V. (UNTs, Khar'kovskij Fiziko-Tekhnicheskij Inst (Ukraine)); Zvyagintsev, A.V.; Lymar', A.G.; Suryadnyj, A.V.; Khizhnyak, N.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The rig designed for investigating ion dynamics at accelerating structures with spatial-periodic quadrupole focusing having match box type electrodes is described. Characteristics of accelerating structures having different geometry of accelerating cells and different laws of accelerating field variation along the structure are investigated. It is shown that the given structure provides efficient transversal focusing of ions. 5 refs., 2 figs.

24089 (JINR-D–9-92-455, pp. 497-499) **To the theory of two-beam ion accelerator on the base of a spiral waveguide.** Reshetnikova, K.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Ion acceleration rate is investigated on the base of the solution of self-consistent system of hydrodynamic equations considering Cherenkov interaction of beam with two-beam ion accelerator structure. It is shown that ion acceleration rate may be enhanced at a such accelerator at the expanse of using relativistic hallow electron beam of a waveguide placed in a static magnetic field decaying along the axis. 3 refs.

24090 (LBL–36565) **Surveying the monument system at Lawrence Berkeley Laboratory's Advanced Light Source accelerator.** Thur, W.; Lauritzen, T. Lawrence Berkeley Lab., CA (United States). Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950512–284: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014836. Source: OSTI; NTIS; GPO Dep.

Particle accelerators with demanding alignment requirements face a need for periodic re-surveying of their reference monument systems. At the ALS, significant foundation settling and the necessary relocation of some floor monuments mean that the entire system of over 100 monuments must be re-surveyed to an accuracy of 100 microns at two year intervals. Last Fall, the monument survey was conducted entirely by the in-house Survey and Alignment crew using a simplified instrument mounting system and an inexpensive commercial software package. Precision levels, plummets, theodolites, and an electronic distance measuring system were used with the innovative "Monopod" instrument mounting system in a cost effective approach to this critical task.

24091 (LS–191) **Nomenclature and name assignment rules for the APS storage ring.** Decker, G. Argonne National Lab., IL (United States). 16 Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015224. Source: OSTI; NTIS; INIS; GPO Dep.

Because the APS accelerators are moving into the fabrication/assembly/installation stage, it is important for consistent naming conventions to be used throughout the project. The intent of this note is to dictate the rules to be adhered to when naming devices in the storage ring. These rules are generic in nature, and shall be applied in principle to the other machines as well. It is essential that every component have a unique and, hopefully, easily recognizable name. Every ASD and XFD group, except for magnets, must interface with the control system. For this reason all device names were developed keeping in mind their actual function, such as controlling or monitoring some device in the ring. Even though magnets are not directly interfaced to the control system, their power supplies are; therefore, a magnet will have the same name as its associated power supply.

24092 (SLAC-PUB–95-6825) **The SLC as a second generation linear collider.** Spencer, J.E. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–179: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013423. Source: OSTI; NTIS; INIS; GPO Dep.

With enough luminosity, the SLC could contribute to most of the high energy physics of current interest such as new hadrons, quark molecules, gluebaus and studies of the Standard Model and Minimal Supersymmetric SM in the form of particle searches for the lowest mass Higgs or selectron or tests of the point-like predictions for the W, Z or $\tilde{e}_R$. Some experiments require alternative incident channels such as $e\gamma$ and $\gamma\gamma$ but only modest increases in energy. Just as the SLC was a prototype for the NLC, it could also be a prototype for a general or γ linear collider – a GLC. Because the main problem is luminosity, we give a scaling relation based on multiple bunches per R-F pulse. We then ask what is possible for the SLC in terms of bunch and train current, emittance and energy at the IP. The results suggest a phased development with the Higgs as a possible last step requiring a luminosity $L \geq 10^{32}$.

24093 (SSCL–675) **PAC++: Object-oriented platform for accelerator codes.** Malitsky, N.; Reshetov, A.; Bourianoff, G. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1994. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011192. Source: OSTI; NTIS; INIS; GPO Dep.

Software packages in accelerator physics have relatively long life cycles. They had been developed and used for a wide range of accelerators in the past as well as for the current projects. For example, the basic algorithms written in the first accelerator Program TRANSPORT are actual for design of most magnet systems. Most of these packages had been implemented on Fortran. But this language is rather inconvenient as a basic language for large integrated projects that possibly could include real-time data acquisition, data base access, graphic riser interface modules (GUI), arid other features. Some later accelerator programs had been based on object-oriented tools (primarily, C++ language). These range from systems for advanced theoretical studies to control system software. For the new generations of accelerators it would be desirable to have an integrated platform in which all simulation and control tasks will be considered with one point of view. In this report

the basic principles of an object-oriented platform for accelerator research software (PAC++) are suggested and analyzed. Primary objectives of this work are to enable efficient self-explaining realization of the accelerator concepts and to provide an integrated environment for the updating and the developing of the code.

24094 (SSCL-Preprint–507) **Underground measurements of seismic vibrations at the SSC site.** Shiltsev, V.D.; Parkhomchuk, V.V.; Weaver, H.J. Superconducting Super Collider Lab., Dallas, TX (United States). 17 Mar 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011788. Source: OSTI; NTIS; INIS; GPO Dep.

The results of underground measurements of seismic vibrations at the tunnel depth of the Superconducting Super Collider (SSC) site are presented. Spectral analysis of the data obtained in the frequency band from 0.05 Hz to 1500 Hz is performed. It is found that amplitudes of ambient ground motion are less than requirements for the Collider, but cultural vibrations are unacceptably large and will cause fast growth of transverse emittance of the SSC beams.

24095 (SSCL-Preprint–558) **Shielding consideration for the SSCL experimental halls.** Bull, J.; Coyne, J.; Mokhov, N.; Stapleton, G. Superconducting Super Collider Lab., Dallas, TX (United States). Mar 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-940424–38: 8. international conference on radiation shielding, Arlington, TX (United States), 24-27 Apr 1994). Order Number DE95011037. Source: OSTI; NTIS; INIS; GPO Dep.

The Superconducting Super Collider which is being designed and built in Waxahachie, Texas consists Of series of proton accelerators, culminating in a 20 Te proton on proton collider. The collider will be in a tunnel which will be 87 km in circumference and. on average about 30 meters underground. The present design calls for two large interaction halls on the east side of the ring. The shielding for these halls is being designed for an interaction rate of 10^9 Hz or 10^{16} interactions per year, based on 10^7 seconds per operational year. SSC guidelines require that the shielding be designed to meet the criterion of 1mSv per year for open areas off site 2mSv per year for open areas on site, and 2mSv per year for controlled areas. Only radiation workers will be routinely allowed to work in controlled areas. It should be pointed that there is a potential for an accidental full beam loss in either of the experimental halls, and this event would consist of the loss of the full circulating beam up to 4×10^{14} protons. With the present design. the calculated dose equivalent for this event is about 10% of the annual dose equivalent for the normal p-p interactions, so that die accident condition does not control the shielding. If, for instance, local shielding within the experimental hall is introduced into the calculations, this could change. The shielding requirements presented here are controlled by the normal p-p interactions. Three important questions were addressed in the present calculations. They are (1) the thickness of the roof over the experimental halls, (2) the configuration of the shafts and adits which give access to the halls, and (3) the problem of ground water and air activation.

24096 (SSC-SR–1002) **Supercollider program plan. Phase 1.** Superconducting Super Collider Lab., Dallas, TX (United States). Jan 1985. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011066. Source: OSTI; NTIS; GPO Dep.

The purpose of this plan is to describe the Research and Development activities associated with the SSC (Superconducting Super Collider) Phase I program. This Phase I program will provide a comprehensive conceptual design report and is geared to accomplish specific research and development objectives that are required prior to initiation of Construction (Phase II). The overall program objectives are given in Section 2. The plan for assuring that these objectives are attained is described in the SSC Management Plan. An overall description of the planned. program is provided in Section 5. This Phase I program follows an extensive Reference Design Study conducted for the purpose of assessing technical feasibility and probable costs.

24097 (SSC-SR–1003) **Superconducting Super Collider management plan. Phase 1.** Tigner, M. Superconducting Super Collider Lab., Dallas, TX (United States). Feb 1986. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011067. Source: OSTI; NTIS; GPO Dep.

This document is the management plan for the Phase I tasks of the Superconducting Super Collider (SSC) program. Phase I involves Research and Development on SSC accelerator components and systems in order to optimize performance and operating reliability with minimum fabrication and operating costs. Development and demonstration of systems reliability and manufacturability is a major goal of these activities. A Conceptual Design Report, cost estimate and construction schedule along with associated documentation will be prepared.

24098 (SSC-SR–1005) **Report of the task force on SSC commissioning and operations.** Lawrence Berkeley Lab., CA (United States). SSC Central Design Group. 1 Jul 1985. 318p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011069. Source: OSTI; NTIS; GPO Dep.

In 1985 January a Taskforce was organized to study the impact of magnet design on the commissioning and operation of the SSC. The results of the study, in the form of this report, are intended as one of several sources of input for the Magnet Type Selection Committee. Other major input will come from the Magnet Taskforce, the Test String Taskforce, the Cost Estimating Taskforce, and other study groups. All of these efforts will culminate in a magnet type selection, after which concentrated R&D on the selected magnet can commence. The study began with a one-week workshop, held on the UC Berkeley campus in 1985 January 14–18. An interim report of the Taskforce, based on the results of the Workshop, was published on 1985 January 28 (SSC-05). With very few exceptions, the work of the Taskforce was carried out by the participants in the Workshop, both during the workshop and in the subsequent weeks. This report is the collective effort of that group, whose very substantial contribution of time, effort, and thought is gratefully acknowledged.

24099 (SSC-SR–1008) **Proceedings of the meetings on the SSC between representatives of industry and high energy physics.** Superconducting Super Collider Lab., Dallas, TX (United States). 7 Apr 1985. 95p. Sponsored by USDOE, Washington, DC (United States);Michigan Energy and Resource Research Association, Detroit, MI (United States);Michigan Univ., Ann Arbor, MI (United States). DOE Contract AC35-89ER40486. (CONF-841263–EXC: Workshop on reliability in accelerator operations; Superconductor Super Collider (SSC) seminar on industry and high energy physics, Ann Arbor, MI (United States); Ann Arbor, MI (United States), 6 Dec 1984; 7 jan 1985; CONF-8501128–EXC Order Number DE95011072. Source: OSTI; NTIS; GPO Dep.

This report discusses the following topics: Alternate gradient synchrotron (Brookhaven); reliability and large storage ring (SLAC); and Fermilab and superconducting tevatron magnets.

24100 (SSC-SR–1011) **Interim report.** Lawrence Berkeley Lab., CA (United States). SSC Central Design Group. Jun 1985. 193p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011075. Source: OSTI; NTIS; GPO Dep.

This Interim Report summarizes the research and development activities of the Superconducting Super Collider project carried out from the completion of the Reference Designs Study (May 1984) to June 1985. It was prepared by the SSC Central Design Group in draft form on the occasion of the DOE Annual Review, June 19–21, 1985. Now largely organized by CDG Divisions, the bulk of each chapter documents the progress and accomplishments to date, while the final section(s) describe plans for future work. Chapter 1, Introduction, provides a basic brief description of the SSC, its physics justification, its origins, and the R&D organization set up to carry out the work. Chapter 2 gives a summary of the main results of the R&D program, the tasks assigned to the four magnet R&D centers, and an overview of the future plans. The reader wishing a quick look at the SSC Phase I effort can skim Chapter 1 and read Chapter 2. Subsequent chapters discuss in more detail the activities on accelerator physics, accelerator systems, magnets and cryostats, injector, detector R&D, conventional facilities, and project

planning and management. The magnet chapter (5) documents in text and photographs the impressive progress in successful construction of many model magnets, the development of cryostats with low heat leaks, and the improvement in current-carrying capacity of superconducting strand. Chapter 9 contains the budgets and schedules of the COG Divisions, the overall R&D program, including the laboratories, and also preliminary projections for construction. Appendices provide information on the various panels, task forces and workshops held by the CDG in FY 1985, a bibliography of COG and Laboratory reports on SSC and SSC-related work, and on private industrial involvement in the project.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 24166, 24167, 24252, 24272, 24274, 24281, 24283, 24286, 24301, 24302, 24331, 24333

24101 (ANL/ASD/CP–85016) **Longitudinal instability analysis for the IPNS upgrade.** Harkay, K.; Cho, Y.; Lessner, E. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–169: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013437. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed 1-MW spallation neutron source upgrade calls for a 2-GeV rapidly-cycling synchrotron (RCS) with an intensity of 1.04×10^{14} protons per pulse. Due to the high intensity, the potential exists for collective instabilities. Emphasis is placed on controlling these by (a) minimizing the machine impedance by using a contour-following rf shield and (b) maximizing the momentum spread to make use of Landau damping. The coupling impedance is estimated and is dominated by space charge effects. It is found that the longitudinal microwave stability limit can be exceeded unless the momentum spread is sufficient. A longitudinal tracking code was developed to simulate injection and acceleration, including the effects of space charge and other sources of impedance. With the aid of the simulation, and under the assumptions of the instability theory, we arrive at an rf voltage profile and beam injection parameters which avoid both the instability and beam loss through the entire cycle. The limitations of the analysis are explored.

24102 (ANL/ASD/CP–85017) **Transverse instability analysis for the IPNS Upgrade.** Harkay, K.; Cho, Y. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–232: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013752. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed 1-MW spallation neutron source upgrade calls for a 2-GeV rapidly-cycling synchrotron (RCS) with an intensity of 1.04×10^{14} protons per pulse. The potential exists for the excitation of collective, intensity-dependent transverse instabilities. These can normally be controlled by introducing a betatron tune shift or spread, where care is exercised to avoid single-particle resonance effects. Adjusting the chromaticity using sextupoles to vary the head-to-tail phase shift is compared to introducing Landau damping by octupoles. An option for a feedback system is also examined. The momentum spread used for the transverse analysis was obtained from the requirements for longitudinal stability.

24103 (ANL/ASD/CP–85046) **Investigation of resistive wall instability in the 7 GeV APS storage ring.** Chae, Yong-Chul. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–219: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013700. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Photon Source (APS) storage ring is a 7-GeV light source with 40 straight sections. Intense x-ray beams will be delivered by 34 insertion devices installed in these straight sections. The vacuum chamber for the insertion devices has an elliptical cross section with the gap equal to 8 mm. With this narrow gap, we estimate that the transverse impedance of the ring at the revolution frequency could be as high as 36 MΩ from the resistive wall. By increasing the (unnormalized) chromaticity to 7, we cure the head-tail modes of order up to m=l for all 60 coupled bunch mode patterns around the ring. Tracking results show that the increased sextupole strength resulting from a higher chromaticity does not significantly reduce the dynamic aperture. Since increased chromaticity alone-cannot cure all the head-tail modes, the APS storage ring will have a feedback system to damp the rigid-bunch modes.

24104 (ANL/ASD/CP–85055) **Longitudinal coupling impedance of a hole in an infinite plane screen.** Chae, Yong-Chul. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–228: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013760. Source: OSTI; NTIS; INIS; GPO Dep.

An analytical formula for the longitudinal coupling impedance of a hole is developed using a variational method. We show that the coupling impedance can be expressed as a sum of functional series, whose argument is the dimensionless quantity kd alone, where k is the free-space wave number and d is the radius of the hole. When expanded in powers of kd, we recover the long wavelength result as a limiting case. The numerical evaluation reveals that the impedance can be well modeled by an RLC-resonator circuit. We also show the qualitatively good agreement between the theory and the MAFIA-T3 simulation for the geometry of a hole in a coupled waveguide with rectangular cross section.

24105 (ANL/PHY/CP–85352) **Longitudinal emittance oscillation in a superconducting drift tube linac.** Kim, J.W.; Shepard, K.W. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–240: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013784. Source: OSTI; NTIS; INIS; GPO Dep.

In drift tube linacs a beam energy spread results form the finite beam size. Radial variation of the axial accelerating field induces a beam energy spread, which, in general, will accumulate as the beam passes through successive drift tubes. This paper shows that under some conditions of periodic transverse focusing and longitudinal phase focusing, the correlation between the longitudinal and transverse motion can be used to correct the energy spread. The process of achieving such a correction is first described in a simplified situation, and then demonstrated for a particular tuning using a ray-tracing program which models a low velocity and low charge state linac designed for radioactive ion beams.

24106 (ANL/PHY/CP–85476) **Transverse emittance systematics measured for heavy-ion beams at ATLAS.** Nolen, J.A.; Barlow, T.A.; Beyer, K.A.; Woody, K.A. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–204: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013524. Source: OSTI; NTIS; INIS; GPO Dep.

The horizontal and vertical beam emittances and ellipse parameters are determined at the ATLAS superconducting heavy-ion linac by the well-known method of measuring the beam width at a profile monitor downstream of a quadrupole magnet as a function of the magnet current. Typically six base-to-base beam widths are measured and used in a least-squares fit to an algebraic expression for the three unknown ellipse parameters. The algorithm was derived from the first order matrix equation for the beam sigma matrix transform through the quadrupole singlet and drift to the profile monitor. To date the emittances of five beams from $^{12}C^{4}$, to $^{238}U^{26+}$. have been measured at the entrance of the Positive-ion Injector Linac, yielding normalized values mostly in the range of 0.25–0.30 π mm-mr. These measurements will be extended systematically to several locations to identify possible sources of emittance growth and to develop more systematic beam tuning procedures.

24107 (BNL–61495) **Colliding Crystalline Beams.** Haffmans, A.F.; Maletic, D.; Ruggiero, A.G. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–214: Particle accelerator conference, Dallas, TX

(United States), 1-5 May 1995). Order Number DE95013510. Source: OSTI; NTIS; INIS; GPO Dep.

Crystalline Beams* are an ordered state of an ensemble of ions, circulating in a storage ring, with very small velocity fluctuations. They can be obtained from ordinary warm ion beams with the application of powerful cooling techniques (stochastic, electron, laser, ...). Depending on the focussing properties and dimensions of the storage ring, and on the ion beam density, several ground states are possible. All of them can be visualized as a bundle of n_s symmetrically distributed, parallel strings. The longitudinal ion separation λ is the same for all strings. The minimum temperature that can be achieved depends on die background noise of the cooling technique used. It is required for stability that the vibration amplitude of the ions is only a fraction of the separation λ.

24108 (CONF-910505–443) **CONDOR simulation of an 11.4-GHz traveling wave output cavity.** Goren, Y.; Yu, D. Duly Consultants, Rancho Palos Verdes, CA (United States). [1991]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER81080. From 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC); San Francisco, CA (United States); 6-11 May 1991. Order Number DE95014735. Source: OSTI; NTIS; INIS; GPO Dep.

The CONDOR code is used to simulate the cold test and the beam-induced microwave amplification of an 11.4-GHz, six-cell, disk-loaded, traveling wave cavity. Cold test simulation results are in agreement with a modified Slater's theory. Power extraction at the output port is calculated by launching a train of Gaussian electron bunches through the structure. Results are consistent with recent relativistic klystron experiments using a similar TW output cavity. It is further shown that, depending on operating beam parameters, the power extraction efficiency can be maximized by modification of various cells in the TW structure.

24109 (CONF-910505–444) **Wakefield suppression using beatwave structures.** Yu, D.; Kim, J.S. Duly Consultants, Rancho Palos Verdes, CA (United States). [1991]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER81080. From 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC); San Francisco, CA (United States); 6-11 May 1991. Order Number DE95014736. Source: OSTI; NTIS; INIS; GPO Dep.

A proposed method of suppressing transverse wakefields in an accelerating structure makes use of the fact that superposition of long-range wakes excited by an electron bunch transversing a series of accelerating cells with different transverse frequencies can produce interference cancellation, thereby significantly reducing the magnitudes of the harmful wake potentials. Analytic calculations as well as time-domain and modal sum simulations are performed to the beatwave effects produced by detuned, disk-loaded cavities as function of their transverse frequency spread and the population density.

24110 (CONF-910505–445) **Damping of higher-order modes in a threefold symmetry accelerating structure.** Yu, D. (Duly Consultants, Rancho Palos Verdes, CA (United States)); Kroll, N. Duly Consultants, Rancho Palos Verdes, CA (United States). [1991]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER81080. From 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC); San Francisco, CA (United States); 6-11 May 1991. Order Number DE95014737. Source: OSTI; NTIS; INIS; GPO Dep.

We investigate a waveguide-coupled damping structure with threefold symmetry using the 2-D and 3-D MAFIA codes. Within the frequency range considered, all higher order modes except the TM011 and TE111 modes are heavily damped. Possible ways to detrap these by using asymmetric waveguides offset with respect to the accelerating cavity in the direction of the beam are studied. External Qs and resonant frequencies are calculated using recently developed computer methods.

24111 (FNAL/C–95/171) **Exact map through ideal bends (again?).** Michelotti, L. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950512–262: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014663. Source: OSTI; NTIS; INIS; GPO Dep.

There are three logically independent facets to calculating the transfer map through a bend magnet: physics, geometry, and representation. We will derive the exact map for transit through ideal bends while separating these three, esp., isolating the geometry problem from the other two.

24112 (JINR-D–9-92-455, pp. 153-155) **Correction of nuclotron magnetic field.** Mikhajlov, V.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Shchepunov, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the simulation of magnetic field correction at the Nuclotron (Dubna, JINR) by the Monte Carlo, dynamic and harmonics methods are presented. Possible variants of correctors switching are considered and estimations of fields necessary for the correction are given. The position of correctors and pick-up electrodes in the correction scheme is shown. 6 refs., 2 tabs., 2 figs.

24113 (JINR-D–9-92-455, pp. 277-279) **Calculation of beam radial quality in the U-120K cyclotron.** Borisov, O.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Vorozhtsov, S.B.; Dmitrievskij, V.P.; Mazurkevich, G.E.; Yuldasheva, M.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Effects of beam radial quality and accelerator central region on radial oscillation amplitudes at the 30 MeV U-120K isochronous cyclotron to deliver protons up to 100 μ A are investigated. Three-dimensional distributions of the electric field in the central region of the accelerator are obtained. Beam dynamics in modes from the injection point to the final radius of extraction is studied. The value of radial oscillation amplitudes is determined. 3 refs., 3 figs.

24114 (JINR-D–9-92-455, pp. 289-292) **Calculation of three-dimensional electrostatic field of an accelerator structure on the base of two-dimensional analysis.** Rezvykh, K.A. (Fiziko-Ehnergeticheskij Inst, Obninsk (Russian Federation)); Romanov, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

An algorithm to calculation of the high-voltage accelerator asymmetric electrostatic field based on the two-dimensional analysis is suggested. Calculation accuracy of the spark gap field and the high-voltage accelerator structure is investigated. In the vicinity of maximum field strength the accuracy is $\pm$ 2 - 3%. Two-dimensional analysis of the asymmetric field allows to eliminate the calculational model roughness. 4 refs., 5 figs.

24115 (JINR-D–9-92-455, pp. 342-344) **Calculation of axial-symmetric magnetic fields at the presence of conducting shields with cuttings.** Derendyaev, Yu.S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Dolbilov, G.V.; Karlov, A.A.; Kuznetsov, A.B.; Petrov, V.A.; Smolyakova, T.F. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The technique of the calculation of pulse solenoidal magnetic field radial component shielding with the help of axial-symmetric shields with slits is suggested. Results of the calculation of the SILUND induction electron linac focusing system shielding are compared with the measurement data. 2 refs., 3 figs.

24116 (JINR-D–9-92-455, pp. 419-423) **Spectral-angular characteristics of synchrotron light in an strong-focusing accelerator.** Shishanin, O.E. (Moskovskij Avtomobilestroitel'nyj Inst, Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The problem of electron dynamics in a periodical magnetic field with the field index being much higher than the unit is considered. The obtained solutions are used for investigating Bremsstrahlung radiation. 6 refs., 1 fig.

24117 (JINR-D–9-92-455, pp. 435-438) **Wake field excitation by an electron bunch and charged particle acceleration in an inhomogeneous plasma.** Balakirev, V.A. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Numerical simulation of the excitation of a wake wave in an inhomogeneous plasma by an electron bunch and charged particle acceleration is conducted. 3 refs., 3 figs.

24118 (JINR-D–9-92-455, pp. 439-442) **Charged particle acceleration by a wake field in magnetoactive plasma waveguide.** Balakirev, V.A. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)); Onishchenko, I.N.; Sotnikov, G.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Charged particle acceleration by wake fields in a magnetoactive plasma waveguide is studied. Two peculiarities due to the gyrotropy of a plasma waveguide have been taken into account. On one hand the occurrence of a hybrid wave having the maximum of longitudinal electric field not at the axis of the system but in the volume of a plasma is considered. On the other hand the existence of a higher-hybrid (cyclotron) branch of oscillations is considered too. 7 refs., 4 figs.

24119 (JINR-D–9-92-455, pp. 443-446) **Corrugated plasma column as a slowing-down structure for an accelerator.** Markov, P.I. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)); Onishchenko, I.N.; Sotnikov, G.V.; Fajnberg, Ya.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Dispersion characteristics of a corrugated plasma column produced during plasma or low-energy electron beam injection into a corrugated magnetic field are investigated. 8 refs., 2 figs.

24120 (JINR-D–9-92-455, pp. 447-450) **Two-beam acceleration of charged particles in a corrugated waveguide.** Ostrovskij, A.O. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The scheme of two-beam acceleration of relativistic electrons in a vacuum corrugated waveguide is considered. In the given scheme of acceleration the guiding and driven beams are set at different resonances in relation to electromagnetic wave. It is shown that the usage of a high-current relativistic electron beam may provide the RF-field intensity of 190 MV/m and energy gain rate of 40 MeV/m. 3 refs., 2 figs.

24121 (JINR-D–9-92-455, pp. 451-454) **Beam loading of an active resonator in a stationary mode.** Martynchuk, N.N. (RAN, Fizicheskij Inst im. P.N.Lebedeva, Moscow (Russian Federation)); Lebedev, A.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The optimization of standing wave resonator beam loading at an electron linac is considered. It is shown that in order to realize the maximum energy gain and the minimization of power reflection in a resonator it is necessary to choose the correspondent phase shift introduced by a resonator together with a coupling device, and/or the value of amplitude transfer factor determined only by a coupling device. 4 refs., 4 figs.

24122 (JINR-D–9-92-455, pp. 464-466) **Influence of accelerating field third harmonics on steady-state processes and limiting current of a microtron.** Kol'tsov, A.V. (RAN, Fizicheskij Inst im. P.N.Lebedeva, Moscow (Russian Federation)); Serov, A.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The establishment of acceleration mode in a microtron resonator where the E_{011} oscillation mode is excited by beam current third harmonics is considered. The process of accelerated current steady-state condition at different values of resonator supplying power and cathode different temperatures is considered too. 9 refs., 2 figs.

24123 (JINR-D–9-92-455, pp. 471-476) **Nonlinear regime of performance of a system for damping bunch transverse dipole oscillations in the IHEP accelerator.** Vershinin, A.I. (Institut Fiziki Vysokikh Ehnergij, Protvino (Russian Federation)); Lebedev, O.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Nonlinear mode of operation of a feedback system intended for the suppression of beam transversal dipole oscillations at the IHEP accelerator is experimentally investigated. The feedback circuit during bunch injection operated in nonlinear mode where the initial oscillations suppression took place; at attaining fixated threshold amplitude the transition to the linear mode occurred. It is shown that the visible increase of suppression rate can be obtained in case of having minimal technical aids. Suppression time during injection constituted 1.5 ms. 3 refs., 4 figs.

24124 (JINR-D–9-92-455, pp. 477-479) **Maximum currents in a collective ion accelerator on the base of high-current electron beam in a corrugated structure.** Il'ina, N.V. (RAN, Moskovskij Radiotekhnicheskij Inst, Moscow (Russian Federation)); Rozanov, H.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The process of ion collective acceleration by a hallow electron beam propagating in a strong longitudinal magnetic field in a structure comprising alternating sections of large and smaller radius is investigated. The numerical investigation showed that ion resonance acceleration takes place in a corrugated structure with modulated electron beam. The current of accelerated ions equals to 0.1 A. 7 refs., 2 figs.

24125 (JINR-D–9-92-455, pp. 480-486) **Calculation of non-stationary beam dynamics in an electron linac with short current pulse duration.** Masunov, Eh.S. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (Russian Federation)); Morozov, V.L. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The accurate electrodynamic problem of particle radiation in an inhomogeneous waveguide section matched at the waveguide ends is solved aiming at the calculation of a high-current beam dynamics with account of proper RF-fields. 4 refs., 2 figs.

24126 (JINR-D–9-92-455, pp. 487-489) **Transversal dynamics of a short-pulse beam in a sectional electron linac.** Bulyak, E.V. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)); Kurilko, V.I.; Makhnenko, L.A.; Opanasenko, A.I.; Ryabka, P.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Transversal dynamics of a short-pulse beam in the LUEh - 300 resonance electron linac is investigated. It is shown that accelerated beam limiting charge in the LUEh - 300 is limited not by the level of stored microwave field in the accelerator section but by the beam transversal instability. 4 refs., 2 figs.

24127 (JINR-D–9-92-455, pp. 490-492) **Electron acceleration by nonlinear wakefield in a plasma with mobile ions.** Rozanov, N.E. (RAN, Moskovskij Radiotekhnicheskij Inst, Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Collective acceleration of electrons in a plasma by wake fields is considered. Limiting characteristics for the given collective accelerator with account of plasma ion dynamics are obtained. 5 refs.

24128 (JINR-D–9-92-455, pp. 493) **Self consistent longitudinal dynamics of a bunch in an accelerator based on the Vavilov-Cherenkov effect in a dielectric.** Barsukov, K.A. (Sankt-Peterburgskij Ehlektrotekhnicheskij Inst, Sankt-Peterburg (Russian Federation)); Kanarejkin, A.D.; Kustov, A.L. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Longitudinal dynamics of an electron bunch in a dielectric-loaded waveguide of a wakefield accelerator is investigated. Limitations for an accelerator structure designed for obtaining fields of up to 100 MeV/m are calculated. It is shown that for asymmetrical bunches providing for the increase of the transformation factor, the length where the efficient acceleration can be obtained is much higher than for symmetrical Gauss bunches. 3 refs.

24129 (JINR-D–9-92-455, pp. 494-496) **On the efficiency of coupling of electron beam with ondulator and H-wave fields.** Reshetnikova, K.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The problem of the interaction of magnetized electron beam with slow-down H-wave fields and with ondulator field is solved aiming at the study on nonlinear stabilization of free-electron laser instability modes of operation. 4 refs.

24130 (LA-UR–95-1549) **Electron clearing in the Los Alamos Proton Storage Ring.** Plum, M.A.; Allen, J.; Borden, M.J.; Fitzgerald, D.H.; Macek, R.J.; Wang, T.S. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–150: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011977. Source: OSTI; NTIS; INIS; GPO Dep.

The instability observed in the Los Alamos Proton Storage Ring (PSR) has been tentatively identified as an electron-proton instability. A source of electrons must exist for this instability to occur. The PSR injection section contains the stripper foil, and therefore provides several strong sources of electrons. An electron clearing system was installed in the injection section to clear out these electrons. The system comprised: (1) a foil biasing system to clear the SEM and thermionic electrons, (2) a pair of low-field bending magnets with a Faraday cup to clear the convoy electrons, and (3) two pairs of clearing electrodes, one upstream and one downstream of the stripper foil, to clear the remaining electrons. This paper discusses the design and performance of the Electron Clearing System, and its effect on the instability. Also presented are some results from other charge-collection experiments that suggest there is also substantial electron production in parts of the ring other than the injection section.

24131 (LA-UR–95-1567) **A theoretical study of the electron-proton instability in a long proton pulse.** Wang, Tai-Sen F. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–146: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011972. Source: OSTI; NTIS; INIS; GPO Dep.

The electron-proton instability of a long, intense, and partially neutralized proton bunch is studied by numerically solving the equations of motion for the line centroid of the proton beam and the line centroid of the trapped electrons. The formalism takes into account the effects of variable line densities and alternating-gradient focusing. Good qualitative agreement between the computational results and experimental observations was obtained when applying the theory to the Los Alamos Proton Storage Ring (PSR). Both the case of a clean extraction gap and the case with a few percent of protons in the extraction gap were studied. It is found that with only a few percent neutralization, the PSR beam can become unstable in both cases. The same equations and method were used to study the stability of the proton beam in the accumulator ring of the proposed LANSCE II spallation-neutron source. The results indicate that the e-p instability can also occur in the LANSCE II accumulator ring for only a few percent neutralization.

24132 (LA-UR–95-1568) **Recent progress on beam stability study in the PSR.** Wang, T. (and others); Channell, P.; Cooper, R. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–153: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011971. Source: OSTI; NTIS; INIS; GPO Dep.

A fast transverse instability has been observed in the Los Alamos Proton Storage Ring (PSR) when the injected beam intensity reaches more than 2×10^{13} protons per pulse. Understanding the cause and control of this instability has taken on new importance as the neutron-scattering community considers the next generation of accelerator-driven spallation-neutron sources, which call for peak-proton intensities of 10^{14} per pulse or higher. Previous observations and theoretical studies indicate that the instability in the PSR is most likely driven by electrons trapped within the proton beam. Recent studies using an experimental electron-clearing system and voltage-biased pinger-electrodes for electron clearing and collection support this hypothesis. Experiments have also been performed to study the instability threshold when varying the electron production rate. Theoretical studies include a computer simulation of a simplified model for the e – p instability and the investigation of possible electron confinement in the ring-element magnetic fields. This paper reports some recent results from these studies.

24133 (LNF-P–95-016) **Multi-bunch energy spread induced by beam loading in standing wave structure.** Ferrario, M. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati); Tazzioli, F.; Mosnier, A.; Tessier, J; Serafini, L. Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Apr 1995. 30p. Order Number DE95789751. Source: OSTI; NTIS (US Sales Only).

The interaction of a relativistic beam with the modes of the TM_{010} pass-band of a multicell cavity does not cause any problem: although all the modes are excited by the RF (radiofrequency) generator, resulting in different cell excitations during the cavity filling and the beam pulse, the net accelerating field exhibits negligible fluctuations from bunch to bunch. However, when the beam is not fully relativitstic, this is no more true. The phase slippage occurring in the first cells, between the non relativistic beam and the lower pass-band modes, produces an effective enhancement of the shunt impedances, which is usually negligible for a relativistic beam in a well tuned cavity. Moreover, the voltage jumps (amplitude and phase) occurring at each bunch passage, as well as the beam detuning caused by the off-crest bunches, vary from cell to cell. These effects enhance dramatically the fluctuation of the accelerating voltage, with a dominant beating provided by the pass-band mode nearest to the pi-mode. The induced beam energy spread has been estimated by the help of two distinct codes, developed at Frascati (Italy) and (Saclay), with results in good agreement. While an interaction integral is computed at each bunch passage, the cavity refilling is calculated by solving coupled differential equations of the modes of the pass-band, driven by a generator linked to one end-cell. It is shown also that the intermode coupling arises from the external Q of the drive end-cell, and not from the wall losses. For illustration, the authors applied the method to the beam-loading problem in the SC capture cavity of the low charge injector of the TESLA test facility installed at DESY.

24134 (LS–183) **Difference resonance study on the electron storage ring Aladdin at SRC.** Liu, J. (Argonne National Lab., IL (United States)); Crosbie, E.; Teng, L.; Bridges, J.; Symon, K.; Trzeciak, W. Argonne National Lab., IL (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015398. Source: OSTI; NTIS; INIS; GPO Dep.

We have studied the third-order betatron difference resonance on the electron storage ring Aladdin at SRC. The spare chromaticity correcting sextupoles were utilized to drive the desired harmonics and a pulsed kicker magnet was fired to produce the coherent oscillation of a single beam bunch. We took beam position measurements from four pairs of stripline electrodes and data acquisition devices. We observed the coupling resonance. Several typical measurements are shown. A computer program was written using multipartite tracking to simulate the bunch motion. The simulations agree well both with analytic predictions and with the experimental results.

24135 (LS–196) **Preliminary study of insertion device effect on dynamic aperture using RACETRACK.** Chae, Yong-chul; Crosbie, E.A. Argonne National Lab., IL (United States). 8 May 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015220. Source: OSTI; NTIS; INIS; GPO Dep.

We studied the effects of an insertion device (ID) on the dynamic aperture using the new version of RACETRACK. We found that the nonlinear effect of the ID is the dominant effect on the dynamic aperture reduction compared to the other multipole errors which exist in the otherwise ideal lattice. The previous study of dynamic aperture was based on the assumption that the effect of the fast oscillating terms in L. Smith's Hamiltonian is small, and hence can be neglected in the simulation. The remarkable agreement between the previous study and the current results using RACETRACK, including all effects of the fast oscillating terms, justified those assumptions at least for the APS ring.

24136 (LS–213) **Global DC closed orbit correction experiment on the NSLS x-ray ring.** Chung, Y.; Decker, G.; Evans, K. Argonne National Lab., IL (United States). 15 Sep 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95015568. Source: OSTI; NTIS; INIS; GPO Dep.

In this note are described the global DC closed orbit correction experiments conducted on the X-ray ring at National Synchrotron Light Source (NSLS). The beam response matrix, defined as beam motion at BPM locations per unit kick by corrector magnets, was measured and then inverted using the technique of singular value decomposition (SVD). The product of the inverted matrix and the difference orbit gives the incremental kick strengths necessary to correct the orbit. As a result, the r.m.s. orbit error around the ring was reduced from 208 μm to 61 μm.

24137 (LS–231) **User's manual for elegant Program Version 12.4, Manual Version 1.** Borland, M. Argonne National Lab., IL (United States). 6 May 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015204. Source: OSTI; NTIS; INIS; GPO Dep.

Elegant stands for "Electron Generation and Tracking," a somewhat out-of-date description of a fully 6D accelerator program that now does much more than generate particle distributions and track them elegant, written entirely in the C programming language, uses a variant of the MAD input format to describe accelerators, which may be either transport lines, circular machines, or a combination thereof. Program execution is driven by commands in a namelist format. This document describes the features available in elegant, listing the commands and their arguments. The differences between elegant and MAD formats for describing accelerators are listed. A series of examples of elegant input and output are given. Finally, appendices are included describing the post-processing programs.

24138 (NSA–95-1) **Calculation of beam neutralization in the IPNS-Upgrade RCS.** Chae, Yong-Chul. Argonne National Lab., IL (United States). 26 Jan 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013448. Source: OSTI; NTIS; INIS; GPO Dep.

The author calculated the neutralization of circulating beam in this report. In the calculation it is assumed that all electrons liberated from the background molecules due to the collisional processes are trapped in the potential well of the proton beam. Including the dependence of ionization cross sections on the kinetic energy of the incident particle, the author derived the empirical formula for beam neutralization as a function of time and baseline vacuum pressure, which is applicable to the one acceleration cycle of the IPNS-Upgrade RCS.

24139 (NSA–95-2) **Electron-proton instability in the IPNS-Upgrade RCS: Part I.** Chae, Yong-Chul. Argonne National Lab., IL (United States). 27 Feb 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013447. Source: OSTI; NTIS; INIS; GPO Dep.

The electron-proton instability in the IPNS-Upgrade RCS is investigated in this report. A dispersion relation applicable to the coasting beam is derived, and the approximations used are stated in order to facilitate the understanding of the underlying mechanism of the instability. The threshold of instability in terms of neutralization of the circulating beam is found for the IPNS-Upgrade RCS. The dependence of threshold on the beam size and the lattice tune is also studied and its numerical results are presented.

24140 (NSA–95-3) **Study of synchro-betatron coupling in IPNS upgrade RCS.** Harkay, K.C. Argonne National Lab., IL (United States). 3 Mar 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013449. Source: OSTI; NTIS; INIS; GPO Dep.

The 2 GeV rapidly-cycling synchrotron (RCS) of the proposed 1-MW spallation neutron source upgrade has 16 dispersion-free straight sections and eight straight sections with a dispersion of approximately 1 m. Six of the ten rf cavities are located in dispersion-free straight sections, and the remainder are located in the non-dispersion-free straight sections. The possibility of exciting synchro-betatron resonances is investigated in this paper. It is found that the effect of the coupling is not important to the RCS. Synchro-betatron resonances are driven in single beams by position-dependent energy gains from the accelerating fields. A primary cause is the dispersion at the location of the rf cavities. Longitudinal and transverse motions are coupled due to a transverse deflection associated with a particle crossing the rf cavity

gap. This changes the equilibrium orbit and excites betatron oscillations.

24141 (NSA–95-4) **Study of corrections to the geometrical factor in the space charge impedance for the IPNS upgrade.** Harkay, K.C. Argonne National Lab., IL (United States). 17 Mar 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013446. Source: OSTI; NTIS; INIS; GPO Dep.

Collective instabilities are an important consideration in the 2-GeV rapidly-cycling synchrotron (RCS) of the proposed 1-MW spallation neutron source upgrade due to the very high beam intensity of 1.04×10^{14} protons per pulse. Collective instabilities are intensity-dependent effects which arise due to the electromagnetic wake fields generated by the beam as it interacts with its surroundings. The interactions are characterized by the coupling impedance, which in the RCS is dominated by space charge effects. To minimize the space charge impedance, the vacuum chamber is constructed with a special wire rf shield. Estimating the longitudinal and transverse impedance due to space charge is critical for the beam stability analysis. The standard geometrical factors used to evaluate the space charge impedance assume a uniform, round, unbunched beam in a cylindrical, smooth beam pipe. Two corrections to the geometrical factors have been proposed to account separately for the wire rf-screening cage and the more realistic varying elliptical beam cross-section. These corrections are studied in the case of the RCS. It is found that including these details results in a correction of less than 20%.

24142 (SAND–94-1911) **High-power electron-beam transport in long gas cells from 10^{-3} to 10^{3} Torr nitrogen.** Sanford, T.W.L. Sandia National Labs., Albuquerque, NM (United States). Feb 1995. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941101–11: Meeting of the Division of Plasma Physics of the American Physical Society, Minneapolis, MN (United States), 7-11 Nov 1994). Order Number DE95010334. Source: OSTI; NTIS; GPO Dep.

Measurements and analyses show that the 13-TW, pulsed Hermes-III electron beam, with current near the Alfven limit, has two regimes of stable transport: a low-pressure window (between $\sim$ 1 and $\sim$ 100 mTorr) that is dominated by propagation in the semi-collisionless IFR (ion-focused regime), and a high-pressure window (between $\sim$ 1 and $\sim$ 100 Torr) that is dominated by propagation in the resistive CDR (collision-dominated regime). Below $\sim$ 1 mTorr, there is insufficient ionization to confine the beam; between the windows, the two-stream and hollowing instabilities disrupt propagation; and above $\sim$ 100 Torr, the resistive hose instability degrades propagation.

24143 (SLAC-PUB–95-6684) **Beam distributions beyond RMS.** Decker, F.J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Sep 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-9410219–25: Beam instrumentation workshop, Vancouver (Canada), 2-6 Oct 1994). Order Number DE95013398. Source: OSTI; NTIS; INIS; GPO Dep.

The beam is often represented only by its position (mean) and the width (rms = root mean squared) of its distribution. To achieve these beam parameters in a noisy condition with high backgrounds, a Gaussian distribution with offset (4 parmeters) is fitted to the measured beam distribution. This gives a very robust answer and is not very sensitive to background subtraction techniques. To get higher moments of the distribution, like skew or kurtosis, a fitting function with one or two more parameters is desired which would model the higher moments. In this paper we will concentrate on an Asymmetric Gaussian and a Super Gaussian function that will give something like the skew and the kurtosis of the distribution. This information is used to quantify special beam distribution. Some are unwanted like beam tails (skew) from transverse wakefields, higher order dispersive aberrations or potential well distortion in a damping ring. A negative kurtosis of a beam distribution describes a more rectangular, compact shape like with an over-compressed beam in z or a closed to double-horned energy distribution, while a positive kurtosis looks more like a "Christmas tree" and can quantify a beam mismatch after filamentation. Besides the advantages of the quantification, there are some distributions which need a further investigation like long flat tails which create background particles in a detector. In particle simulations on the other hand a simple rms number might grossly overestimate the effective size (e.g. for producing luminosity) due to a few particles which are far away from the core. This can reduce the practical gain of a big theoretical improvement in the beam size.

24144 (SLAC-PUB–95-6791) **Optimization of the NLC final focus system.** Zimmermann, F.; Helm, R.; Irwin, J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–195: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014655. Source: OSTI; NTIS; INIS; GPO Dep.

An optimization scheme for final focus systems is discussed and applied to the NLC design. The optical functions at the defocusing sextupoles, the sextupole strength, and the length of the system must obey eight conditions that are imposed by the spot size increase due to higher-order aberrations, the effects of synchrotron radiation in the bending magnets, power supply ripple, magnet vibration tolerances, and the estimated orbit stability at the sextupoles. These eight conditions determine the minimum optimum length of the system. The NLC final focus design was shortened to this optimum.

24145 (SLAC-PUB–95-6802) **Coupling impedance of a periodic array of diaphragms.** Stupakov, G.V. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–184: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014648. Source: OSTI; NTIS; INIS; GPO Dep.

A method is presented for calculating the high-frequency longitudinal and transverse coupling impedances in a periodic array of diaphragms in a circular perfectly conducting pipe. The method is based on Weinstein's theory of diffraction of a plane electromagnetic wave on a stack of halfplanes. Using Weinstein's solution, it is shown that the problem of finding the beam field in the pipe reduces to an effective boundary condition at the radius of the diaphragms that couples the longitudinal electric field with the azimuthal magnetic one. Solving Maxwell's equations with this boundary condition leads to simple formulae for Z_{long} and Z_{tr}. A good agreement with a numerical solution of the problem found by other authors is demonstrated.

24146 (SLAC-PUB–95-6806) **Flat beam spot sizes measurement in the SLC-final focus.** Raimondi, P.; Decker, F.J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–223: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014542. Source: OSTI; NTIS; INIS; GPO Dep.

With the switch to flat beam operation in the SLC during the 1993 run, it has become necessary to develop an algorithm that is capable of measuring the beam spot sizes at the Final Focus Interaction Point (IP). This algorithm uses the correct beam-beam deflection formula for the more general flat-beam case, since the round beam approximation is no longer valid. The application of this formula to the IP spot size measurements in the SLC Final Focus is the subject of this paper.

24147 (SLAC-PUB–95-6840) **Fast symplectic mapping and quasi-invariants for the Large Hadron Collider.** Warnock, R.L. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Berg, J.S.; Forest, E. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–177: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013378. Source: OSTI; NTIS; INIS; GPO Dep.

Beginning with a tracking code for the LHC, we construct the canonical generator of the full-turn map in polar coordinates. For very fast mapping we adopt a model in which the momentum is modulated sinusoidally with a period of 130 turns (very close to the synchrotron period). We achieve symplectic mapping of 10^7 turns in 3.6 hours on a workstation. Quasi-invariant tori are constructed

on the Poincare section corresponding to multiples of the synchrotron period. The possible use of quasi-invariants in derivin, long-term bounds on the motion is discussed.

24148 (SSCL–564) **On the feasibility of tracking with differential-algebra maps in long-term stability studies for large hadron colliders.** Kleiss, R. (CERN, Geneva (Switzerland)); Schmidt, F.; Yan, Y. Superconducting Super Collider Lab., Dallas, TX (United States). Jan 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (DESY-HERA–92-01; CERN-SL–92-02(AP)). Order Number DE95011201. Source: OSTI; NTIS; INIS; GPO Dep.

A time-saving alternative to conventional element-by-element tracking in long-term stability studies is the use of truncated Taylor maps. This report discusses how the non-symplecticity of a moderately high-order truncated Taylor map affects its reliability when the map is used for tracking over several thousand turns. Various machines and two different map-constructing programs are compared. It is found that the discrepancies between the Taylor map results and those obtained by direct tracking grow with amplitude. Thus, such maps are not guaranteed to be sufficient for long-term tracking over millions of turns without suitable symplectification.

24149 (SSCL–640) **Passing through half-integer resonance due to space charge under different initial distributions.** Senichev, Y. (Superconducting Super Collider Lab., Dallas, TX (United States)); Budzko, A. Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011183. Source: OSTI; NTIS; INIS; GPO Dep.

The problem of space charge continues to be interesting in connection with the development of the Kaon and Neutron Facilities and the Superconducting Super Collider projects. In the former, the high average intensity of the proton beam can be reached by a super-high pick current in each acceleration cycle, giving rise to the painting procedure. In colliders, as is known, super luminosity can be reached by minimization of emittance growth under acceleration. In other words, the task consists of the beam acceleration with the maximum attainable density of current and with minimum achievable emittance growth. This is why this task arises when new accelerator projects are developed. There are at least two ways to investigate the space-charge effects on the designing stage: analytical and numerical simulations. Each has its own advantages and disadvantages. The numerical simulation, with its use of macro particles approximation, is very well developed but it requires a lot of computer time and has limited flexibility in the variation of the initial conditions. As a result, the numerical methods are restricted in optimization possibility. Analytical investigation gives a clearer idea about physical phenomena, but it must simplify the physical model and sometimes gives an incorrect interpretation of results. Analytical research can be divided into two types: the envelope equation method for self-consistent distribution, and the nonlinear equation for higher distribution moments. In our work we use numerical simulation as the base to achieve the correct results, but for interpretation of results the simplified analytical model is used as well.

24150 (SSCL-Preprint–513) **New transverse damper correction scheme.** Lopez, G. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011219. Source: OSTI; NTIS; INIS; GPO Dep.

A transverse damping system for providing beam motion stability against Dipole Mode Multibunch Instabilities (DMMI) in the Superconducting Super Collider (SSC) is outlined. This damper makes use of two monitors and one kicker, as in existing designs. The novel feature is the use of a new correction scheme, which provides exact orbit compensation within two turns.

24151 (SSCL-Preprint–519) **Compensation of the beam-beam effect in proton-proton colliders.** Tsyganov, E. (Superconducting Super Collider Lab., Dallas, TX (United States)); Meinke, R.; Nexsen, W.; Zinchenko, A. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011217. Source: OSTI; NTIS; INIS; GPO Dep.

Compensation of the beam-beam effect in high-energy proton-proton colliders using a low-energy electron beam is proposed. It is concluded that such compensation looks feasible. Requirements for such a device are formulated.

24152 (SSCL-Preprint–550) **Principles of interaction region design in Hadron Colliders and their application to the SSC.** Nosochkov, Y.; Sen, T.; Courant, E.; Garren, A.; Ritson, D.M.; Stirninh, T.; Dyphrtd, M.J. Superconducting Super Collider Lab., Dallas, TX (United States). Jan 1994. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011033. Source: OSTI; NTIS; INIS; GPO Dep.

The high luminosity Interaction Regions (IRs) are an important part of the lattice in colliding beam machines. The performance of the collider may depend significantly on the particular design of the IRs. In this paper we discuss the general principles of IR design and apply these principles to the design of the Superconducting Super Collider Interaction Regions.

24153 (UCRL-JC–119186) **Analytic electrostatic solution of an axisymmetric accelerator gap.** Boyd, J.K. Lawrence Livermore National Lab., CA (United States). 15 Mar 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950512–224: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014157. Source: OSTI; NTIS; INIS; GPO Dep.

Numerous computer codes calculate beam dynamics of particles traversing an accelerating gap. In order to carry out these calculations the electric field of a gap must be determined. The electric field is obtained from derivatives of the scalar potential which solves Laplace's equation and satisfies the appropriate boundary conditions. An integral approach for the solution of Laplace's equation is used in this work since the objective is to determine the potential and fields without solving on a traditional spatial grid. The motivation is to quickly obtain forces for particle transport, and eliminate the need to keep track of a large number of grid point fields. The problem then becomes one of how to evaluate the appropriate integral. In this work the integral solution has been converted to a finite sum of easily computed functions. Representing the integral solution in this manner provides a readily calculable formulation and avoids a number of difficulties inherent in dealing with an integral that can be weakly convergent in some regimes, and is, in general, highly oscillatory.

4303 Auxiliaries and Components

Refer also to citation(s) 23691, 23920, 24038, 24091, 24142, 24146, 24299, 24300, 24328, 24332, 24335, 24336, 24337, 24338, 24339, 24340, 24341, 24343, 24345, 24348, 24349, 24354, 24374, 24379, 24766, 24767, 24777, 24903, 25026, 25028

24154 (ANL/ASD/CP–83556) **APS injector synchrotron low-level RF system design and test.** Stepp, J.D.; Bridges, J.F. Argonne National Lab., IL (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-940618–121: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE95015835. Source: OSTI; NTIS; INIS; GPO Dep.

We describe the control of the RF system for the injector synchrotron (booster) of the 7-GeV Advanced Photon Source. The rf system consists of one klystron and four 5-cell cavities of the LEP type. A block diagram of the system is shown and the low power rf circuitry is described. Voltage and phase feedback are discussed, along with accelerating the beam to 7 GeV. The accelerating voltage is programmed with a waveform generator. Although the acceleration is constant, the power at injection is almost zero and at extraction it is near 600 kW. The power increases with beam energy to replace synchrotron radiation losses. Stability of the rf phase between the two sides of the ring are discussed. Control signals are described which synchronize the bunch during injection from an accumulator ring and for extraction to the 352-MHz bucket in the storage ring. Timing for injection into any bucket in the Storage Ring is accomplished in the rf controls interface located on the VM cards. There is only one bunch accelerated in the booster at a

time, so the beam loading of the cavities is negligible. Operating experience during early commissioning efforts will also be outlined.

24155 (ANL/ASD/CP–84923) **A photocathode rf gun design for a mm-wave linac-based FEL.** Nassiri, A.; Berenc, T.; Foster, J.; Waldschmidt, G.; Zhou, J. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–258: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013724. Source: OSTI; NTIS; INIS; GPO Dep.

In recent years, advances in the rf gun technology have made it possible to produce small beam emittances suitable for short period microundulators which take advantage of the low emittance beam to reduce the wavelength of FELs. At the Advanced Photon Source, we are studying the design of a compact 50-MeV superconducting mm-wave linac-based FEL for the production of short wavelengths (~300 nm) to carry out FEL demonstration experiments. The electron source considered for the linac is a 30- GHz, 3 1/2-cell π-mode photocathode rf gun. For cold model rf measurements a 15-GHz prototype structure was fabricated. Here we report on the design, numerical modelling and the initial cold-model rf measurement results on the 15-GHz prototype structure.

24156 (ANL/ASD/CP–84924) **Beamline smoothing of the Advanced Photon Source.** Friedsam, H.; Penicka, M.; Zhao, S. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–171: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013415. Source: OSTI; NTIS; GPO Dep.

This paper outlines a general beamline smoothing concept based on the use of First Principle Component analysis. Bean-dine smoothing is commonly used for the detection of blunders in the positioning of beam elements and to provide a smooth particle beam path with the fewest adjustments to individual beam components. It also provides the data for assessment of the achieved positioning quality.

24157 (ANL/ASD/CP–84987) **Initial tests of the dual-sweep streak camera system planned for APS particle-beam diagnostics.** Lumpkin, A. (Argonne National Lab., IL (United States)); Yang, B.; Gai, W.; Cieslik, W. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–247: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013774. Source: OSTI; NTIS; INIS; GPO Dep.

Initial tests of a dual-sweep streak system planned for use on the Advanced Photon Source (APS) have been performed using assets of the Argonne Wakefield Accelerator (AWA) facility. The short light pulses from the photoelectric injector drive laser in both the visible (λ=496 nm, Δt~1.5 ps (FWHM)), and the ultraviolet (λ=248 nm, Δt~5 ps (FWHM)) were used. Both a UV-visible S20 photocathode streak tube and a UV-to-x-ray Au photocathode streak tube were tested. Calibration data with an etalon were also obtained. A sample of dual-sweep streak data using optical synchrotron radiation on the APS injector synchrotron is also presented.

24158 (ANL/ASD/CP–84989) **Preliminary calculations on the determination of APS particle-beam parameters based on undulator radiation.** Lumpkin, A. (Argonne National Lab., IL (United States)); Yang, B.; Chung, Y.; Dejus, R.; Voykov, G.; Dattoli, G. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–251: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013776. Source: OSTI; NTIS; INIS; GPO Dep.

The potential measurement of particle beam emittance at a third-generation synchrotron radiation facility such as the Advanced Photon Source (APS) by characterizing the observed undulator radiation from an insertion device is considered. The nominal APS particle beam parameters have been used in calculations for insertion devices which periods of λ=3.3 cm, λ=5.0 cm (in two configurations), and λ=1.8 cm. The US program, the MDK1F program, and analytical formulae were used. Sensitivity to variations of emittance by 20% from the nominal value are addressed.

24159 (ANL/ASD/CP–84990) **Initial diagnostics commissioning results for the Advanced Photon Source (APS).** Lumpkin, A. (and others); Patterson, D.; Wang, X. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–248: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013775. Source: OSTI; NTIS; INIS; GPO Dep.

Principal diagnostics systems have been installed and nearly all have been commissioned on the subsystems of the Advanced Photon Source (APS) facility. Data have been obtained on beam position, beam profile, current, beam loss rate, and synchrotron radiation monitors on both injector rings and most recently the main 7-GeV storage ring. Results for the 150- to 450-MeV electron beams in the accumulator ring, up to 7 GeV in the injector synchrotron, and 4.5 to 7 GeV in the SR will be presented.

24160 (ANL/ASD/CP–84991) **Status of the synchrotron radiation monitors for the APS facility rings.** Lumpkin, A.; Yang, B. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–206: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013527. Source: OSTI; NTIS; INIS; GPO Dep.

Initial results from the Optical synchrotron radiation (OSR) monitors for the Advanced Photon Source (APS) have been obtained. Data using electron beams on the positron accumulator ring (PAR) at 400 MeV, the injector synchrotron (IS) up to 7-GeV, and the main storage ring (SR) at 4.5 and 7 GeV address both transverse profiles and/or longitudinal bunch length. Recent measurements on OSR transported outside of the PAR and IS enclosures include transverse damping information. Streak camera and photodiode detectors have been used to measure bunch length compression σ_t = 1000 to 400 ps on the PAR and damping on the IS of σ_t = 200 to 75 ps. First transverse images have been recorded on the main ring from a single turn and for stored beam.

24161 (ANL/ASD/CP–84996) **Design and testing of a high power, ultra-high vacuum, dual-directional coupler for the Advanced Photon Source (APS) linear accelerator.** Brauer, S.O.; Grelick, A.E.; Grimmer, J.; Otocki, R.D.; Kang, Y.W.; Noonan, J.; Russell, T. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–245: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013770. Source: OSTI; NTIS; INIS; GPO Dep.

Leaks and cracks have developed in the vacuum windows of the linac WR 284 waveguide directional couplers. In the existing coupler design the vacuum window is brazed to the waveguide. Replacement of a cracked window requires the removal of the component from the waveguide system resulting in a loss of vacuum in the waveguide. A new design has been developed and a prototype tested that utilizes bolted-in vacuum windows and allows for easier replacement of the windows in the system, while still providing suitable radio frequency (rf) specifications.

24162 (ANL/ASD/CP–85007) **The APS direct-drive pulsed septum magnets.** Sheynin, S.; Lopez, F.; Milton, S.V. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–231: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013754. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Photon Source (APS) consists of four separate machines: linac, booster, positron accumulator ring (PAR) and storage ring (SR), plus three transfer lines interconnecting the machines. At least one thin, pulsed septum magnet is located at each splice joint. The stray field tolerances for two of these septum magnets are very stringent. As an example, for clean operation during the proposed top-up mode in the storage ring, the stray fields from the septum magnet must not exceed 1 G-m. The septum wall thickness must also not exceed 2.4 mm. To meet these requirements, direct-drive septum magnets with magnetic shield pipe around the stored beam region were developed and built. These magnets have now been tested and installed, and are used in daily

operation. We describe the magnet(s) design, the measurement results, the actual operation, and performance.

24163 (ANL/ASD/CP–85009) **Bunch length measurements at the Advanced Photon Source (APS) linear accelerator.** Sereno, N.S.; Fuja, R.; Gold, C.; Grelick, A.E.; Nassiri, A.; Song, J.J.; White, M. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–235: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013756. Source: OSTI; NTIS; INIS; GPO Dep.

Measurements of the APS linac micro-bunch length are performed by backphasing a single 2856-MHz, S-band linac waveguide and using a downstream spectrometer to observe the beam. By measuring the beam width in the dispersive plane as a function of rf power into the linac waveguide, the bunch length can be determined absolutely provided the beam energy and dispersion at the spectrometer are known. The bunch length determined in this fashion is used to calibrate a fifth-harmonic bunch length cavity which is used for real-time bunch length monitoring.

24164 (ANL/ASD/CP–85010) **Commissioning of the Argonne positron accumulator ring.** Borland, M. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–234: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013753. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Photon Source (APS) injector consists of a 250-MeV electron linac, a 450-MeV positron linac, a 450-MeV positron accumulator ring (PAR), and a 7-GeV synchrotron. The purpose of the PAR is to accumulate and damp positrons from the 60-Hz linac during each cycle of the 2-Hz synchrotron, thus increasing the fill rate for the main ring. This paper discusses the rapid progress of PAR commissioning. Less than a year was required from first acceptance of beam to transfer of PAR operations to the APS Operations Group. PAR has been well characterized and already meets most of its design specifications. An accurate model has been developed for linear and chromatic properties. Hardware improvements are planned to allow specifications to be fully met.

24165 (ANL/ASD/CP–85048) **Positron focusing in the Advanced Photon Source (APS) linear accelerator.** Qian, Y.L.; White, M. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–230: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013758. Source: OSTI; NTIS; INIS; GPO Dep.

Positrons are created by a bremsstrahlung shower process, and are therefore produced with broad divergence and a large energy spread. The e^+/e^- conversion ratio is on the order of 1/200, so the positron focusing system is critical to ensure good positron capture and transport efficiency. The positron focusing system is described, and functions of the different magnetic elements are discussed. Some improvements to the focusing system are suggested, although the linac's design positron intensity of 8 mA has already been achieved.

24166 (ANL/ASD/CP–85051) **Injecting a Kapchinskij-Vladimirskij distribution into a proton synchrotron.** Crosbie, E. (Argonne National Lab., IL (United States)); Symon, K. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–229: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013759. Source: OSTI; NTIS; INIS; GPO Dep.

Recently it has been suggested that the Kapchinskij Vladimirskij (KV) distribution may be of practical interest for high intensity machines in that it may provide the maximum space charge limit for such a machine. One can be make a plausible argument that the maximum beam intensity is obtained for a distribution for which all particles have the same tune, at least when the resonance is approached. Therefore, the following steps should be taken: first, reduce the chromaticity of the accelerator ring as much as possible, and second, make the betatron frequencies independent of amplitude, i.e., make the focusing forces linear. One way to make the focusing forces linear is to start with external focusing forces which are linear, and then make the space charge forces also linear by using a K-V distribution. Sections II and III describe two injection scenarios which produce a KV distribution (if we neglect beam-beam interactions during the injection process.) Simulations of these injection scenarios verify that the resulting distribution produces a uniform circular beam in xy-space. A simulation code was written which also includes the space charge interactions between the 500 injected turns in the proposed scenarios; the results are given in section IV. The space charge forces have a substantial effect on the resulting distribution.

24167 (ANL/ASD/CP–85056) **Advanced Photon Source insertion device field quality and multipole error specification.** Chae, Yong-Chul; Decker, G. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–227: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013761. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Photon Source (APS) storage ring is a 7-GeV light source with forty straight sections. Intense x-ray beams will be delivered by insertion devices installed in these straight sections. Installation of insertion devices in the APS storage ring produces several effects which can degrade overall performance. Rigid ring performance requirements exist which can be used to set limits on insertion device field quality, i.e. the first- and second-field integrals of the transverse magnetic field. Individual multipole error specifications can be determined by considering the lifetime of the beam. For nominal operation of the APS storage ring, the vertical aperture corresponding to a 10-hour lifetime is approximately 3.35 mm, which limits the level of multipole error. We find that the skew-octupole error has the most significant effect on the reduction of the aperture; the reasons are discussed in this paper.

24168 (ANL/ASD/CP–85063) **Digital signal processing for the APS transverse and longitudinal damping system.** Barr, D.; Sellyey, W. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–242: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013779. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Photon Source (APS) at Argonne National Laboratory will be a 7-GeV machine. It is anticipated that for beam operations beyond the baseline design of 100 mA stored beam current, a transverse and longitudinal damping system is needed to damp instabilities. A key part of this digital damping system is digital signal processing. This digital system will be used to process samples taken from the beam and determine appropriate correction values to be applied to the beam. The processing will take the form of a transversal digital filter with adaptable filter weights. Sampling will be done at 176 MHz with a possible correction bandwidth of 88 MHz. This paper concentrates on the digital processing involved in this system, and especially on the adaptive algorithms used for determining the digital filter weights.

24169 (ANL/ASD/CP–85065) **Implementation status of the global and local beam position feedback systems for the Advanced Photon Source storage ring.** Chung, Y.; Barr, D.; Decker, G.; Galayda, J.; Kirchman, J.; Lenkszus, F.; Lumpkin, A.; Votaw, A.J. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–220: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013780. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Photon Source (APS) is implementing an extensive beam position feedback system for both global and local stabilization of particle and photon beams based on digital signal processing. The description and operational experience of the system will be given in this paper. In particular, we will discuss the underlying fundamental principles, hardware layout, controls interface, and automatic software generation for multiple digital signal processors (DSPS) distributed in 20 VME crates around the ring. The feedback system runs at 4-kHz sampling frequency in order to achieve the correction bandwidth of approximately 100 Hz. For the maximum correction efficiency and resolution of conflicts among

multiple local feedback systems due to the local bump closure error, the global and local feedback systems are combined into a single unified system. This novel approach is made possible through data sharing among the global and local systems via the fiber-optically networked reflective memories.

24170 (ANL/ASD/CP–85097) **Performance of the advanced photon source (APS) linac beam position monitors (BPMs) with logarithmic amplifier electronics.** Fuja, R.E.; White, M. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–239: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013782. Source: OSTI; NTIS; INIS; GPO Dep.

This paper discusses the performance of the logarithmic amplifier electronics system used with stripline BPMs to measure electron and positron beam positions at the APS linac. The 2856-MHz, S-band linac accelerates 30-nsec pulses of 1.7 A of electrons to 200 MeV, and focuses them onto a positron conversion target. The resulting 8 mA of positrons are further accelerated to 450 MeV by the positron linac. Beam position resolutions of 50 μm are easily obtainable in both the electron and positron linacs. The resolution of the 12-bit A/D converters limits the ultimate beam positron resolution to between 20 and 30 μm at this time.

24171 (ANL-HEP-CP–95-35) **Witness gun for the Argonne Wakefield Accelerator.** Power, J.; Simpson, J.; Chojnacki, E.; Konecny, R. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950512–182: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013491. Source: OSTI; NTIS; INIS; GPO Dep.

The witness gun for the Argonne Wakefield Accelerator (AWA) is a six-cell, copper, iris loaded, rf photocathode operating at 1.3 GHz in a $\pi/2$ standing wave mode. An intense drive beam (up to 100 nC @ 20 psec FWHM) used in the AWA project to excite (i.e. drive) wakefields in at least two separate test devices: a dielectric loaded cylindrical waveguide and a plasma cell. In both cases a low charge, low emittance witness beam (0.1 nC charge, 1 πmm-mrad 90% physical emittance) is required to probe (i.e. witness) the wakefields left behind by the drive beam. This paper will primarily discuss the recent progress in the construction of the witness gun, while also briefly summarizing the central design issues of the gun. A brief status report on the dielectric witness gun option is also included. The authors conclude with a short statement on the near term future plans.

24172 (ANL/PHY/CP–85353) **A low-charge-state injector linac for ATLAS.** Shepard, K.W.; Kim, J.W. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–241: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013785. Source: OSTI; NTIS; INIS; GPO Dep.

The design of a low-charge-state linac which is capable of accelerating, for example, $^{132}Sn^{1+}$ for injection into the existing heavy-ion linac ATLAS is discussed. The injector linac is intended for radioactive beam applications, and will accelerate a low-charge-state beam to energies of 500 keV/nucleon, at which point the ions can be stripped to charge states sufficiently high to be injected into ATLAS. A primary design goal has been to extend the very good longitudinal beam quality typical of ATLAS to low charge state beams. The proposed injector linac consists of several elements. First is a gridded-gap four-harmonic buncher and a short (normally-conducting) 12 MHz RFQ structure, both operating on a 350 kV open-air variable-voltage platform. Then comes an array of 24 Mhz and 48 Mhz superconducting interdigital accelerating structures interspersed with superconducting quadrupole transverse focusing elements. Numerical ray-tracing studies indicate that a transverse acceptance greater than 0.25π mm-mrad can be obtained while simultaneously limiting longitudinal emittance growth to a very few keV-nsec.

24173 (ANL/PHY/CP–85355) **A low-cost non-intercepting beam current and phase monitor for heavy ions.** Bogaty, J.M.; Clifft, B.E. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–236: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013757. Source: OSTI; NTIS; INIS; GPO Dep.

A low cost ion beam measurement system has been developed for use at ATLAS. The system provides nondestructive phase and intensity measurement of passing ion beam bunches by sensing their electric fields. Bunches traverse a short tubular electrode thereby inducing displacement currents. These currents are brought outside the vacuum jacket where a lumped inductance resonates electrode capacitance at one of the bunching harmonic frequencies. This configuration yields a basic sensitivity of a few hundred millivolts signal per microampere of beam current. Beam induced radiofrequency signals are summed against an offset frequency generated by the master oscillator. The resulting difference frequency conveys beam intensity and bunch phase information which is sent to separate processing channels. One channel utilizes a phase locked loop to stabilize phase readings during microsecond beam drop outs. The other channel uses a linear full-wave active rectifier circuit which converts sine wave signal amplitude to a DC voltage representing beam current. Plans are in progress to install this new diagnostic at several locations in ATLAS which should help shorten the tuning cycle of new ion species.

24174 (ANL/PHY/CP–86550) **A high gradient superconducting quadrupole for a low charge state ion linac.** Kim, J.W.; Shepard, K.W.; Nolen, J.A. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–250: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013777. Source: OSTI; NTIS; INIS; GPO Dep.

A superconducting quadrupole magnet has been designed for use as the focusing element in a low charge state linac proposed at Argonne. The expected field gradient is 350 T/m at an operating current of 53 A, and the bore diameter is 3 cm. The use of rare earth material holmium for pole tips provides about 10% more gradient then iron pole tips. The design and the status of construction of a prototype singlet magnet is described.

24175 (ANL/TD/CP–85060) **Generation of high purity cw proton beams from microwave driven sources.** Spence, D.; Lykke, K.R. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–244: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013769. Source: OSTI; NTIS; INIS; GPO Dep.

We describe a technique we have developed to significantly increase the proton fraction extracted from high pressure (mTorr) electron cyclotron resonance (ECR) sources of the type developed by Chalk River Laboratories (CRL). Specifically, this proton enhancement is achieved by the addition of environmentally benign additives (H_2O being the most effective) to the plasma, in molecular concentrations of the order of 1%. Typically, operating under non- resonant source conditions, this technique will enhance the proton fraction from about 75% to greater than 95% for a power input of 700W at 2.45 GHz. Similar results are achieved for deuteron beams. We believe this technique is capable of similar results in arc-discharge (bucket) sources, Penning sources and any other gas discharge sources, under suitable conditions.

24176 (ANL/XFD/CP–85084) **Results of magnetic measurements and field integral compensation for the Elliptical Multipole Wiggler.** Frachon, D.; Ivanov, P.M.; Medvedko, E.A.; Vasserman, I.; Despe, O.; Kang, Y.G. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–172: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013414. Source: OSTI; NTIS; GPO Dep.

A prototype of the Elliptical Multipole Wiggler (EMW) has been assembled, tested and tuned at the APS. This prototype has a period of 160 mm with 7 poles for the hybrid structure and 10 poles for the electromagnet part of the EMW. The hybrid structure of the EMW produces a vertical maenetic field of 0.83 T with K_y= 12 for a

cap of 27 mm, and the electromagnetic structure provides a horizontal field chancre up to 100 Hz with a maximum field of 0.12 T (I= 0.6 kA, K_x= 1.6). The current pulse has a trapezium-type shape with a switching time to chancre the current polarity of about 2 ms. The measurements and tuning, were done for direct current (DC) mode and alternating current (AC) mode. Fine adjustment during the test at the NSLS X-ray ring, using the BPMs and active correction system allowed to achieve about 1 μm of beam distortion. It corresponds to the peak-to-peak variations during, the time less than $\pm$0.5 G-cm and $\pm$100 G-cm^2 of the first and second horizontal field integrals respectively.

24177 (ANL/XFD/CP–86468) **The vacuum system for insertion devices at the Advanced Photon Source.** Trakhtenberg, E.; Gluskin, E.; Den Hartog, P.; Klippert, T.; Wiemerslage, G.; Xu, S. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950512–243: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013767. Source: OSTI; NTIS; INIS; GPO Dep.

A vacuum system for the insertion devices at the Advanced Photon Source was designed, and chambers of this design were successfully manufactured and tested. Three different versions of the vacuum chamber have been developed with vertical apertures of 12 mm, 8mm, and 5 mm, respectively. The chambers are fabricated by extruding 6063 aluminum alloy to form a tube with the desired internal shaped and machining the exterior to finish dimensions. The wall thickness of the completed chamber at the beam orbit position is 1 mm. The design utilizes a rigid strongback that limits deflection of the chamber under vacuum despite the thin wall. Chambers with lengths of 2.2m and 5.2 m have been fabricated. Pumping is accomplished by a combination of lumped and distributed non-evaporable getters and ion pumps. An ultimate pressure of $5.1 \cdot^{-11}$ torr was achieved with the 12-mm vertical aperture prototype. Alignment of the vacuum chamber on its support can be made with a precision of $\pm$ 25 μm in the vertical plane, which allows minimum insertion device pole gaps of 14.5 mm, 10.5 mm, and 7.5 mm.

24178 (APS–3.3.2.1.0) **Advanced Photon Source experimental beamline Safety Assessment Document: Addendum to the Advanced Photon Source Accelerator Systems Safety Assessment Document (APS-3.2.2.1.0).** Argonne National Lab., IL (United States). Jan 1995. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013557. Source: OSTI; NTIS; INIS; GPO Dep.

This Safety Assessment Document (SAD) addresses commissioning and operation of the experimental beamlines at the Advanced Photon Source (APS). Purpose of this document is to identify and describe the hazards associated with commissioning and operation of these beamlines and to document the measures taken to minimize these hazards and mitigate the hazard consequences. The potential hazards associated with the commissioning and operation of the APS facility have been identified and analyzed. Physical and administrative controls mitigate identified hazards. No hazard exists in this facility that has not been previously encountered and successfully mitigated in other accelerator and synchrotron radiation research facilities. This document is an updated version of the APS Preliminary Safety Analysis Report (PSAR). During the review of the PSAR in February 1990, the APS was determined to be a Low Hazard Facility. On June 14, 1993, the Acting Director of the Office of Energy Research endorsed the designation of the APS as a Low Hazard Facility, and this Safety Assessment Document supports that designation.

24179 (BNL–61362) **Skew quadrupole in RHIC dipole magnets at high fields.** Jain, A.; Gupta, P.; Thompson, P.; Wanderer, P. Brookhaven National Lab., Upton, NY (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950691–5: 14. international conference on magnet technology, Tampere (Finland), 11-16 Jun 1995). Order Number DE95015370. Source: OSTI; NTIS; INIS; GPO Dep.

In the RHIC arc dipoles, the center of the cold mass lies above the center of the cryostat. At the maximum design field, the magnetic flux lines leak through the yoke to the asymmetrically located cryostat, which provides an additional return path. This introduces a systematic top-bottom asymmetry leading to a skew quadrupole term at high fields. A similar asymmetry is also created by any difference in weights of the upper and the lower yoke halves. Data from measurements of several RHIC dipoles are presented to study this effect. In the current production series of the RHIC dipoles, an attempt is made to compensate the effect of the cryostat by an asymmetry in the iron yoke. Seven dipoles with this type of yoke have been cold tested, and show a reduced saturation in the skew quadrupole term, as expected.

24180 (BNL–61777) **Quench antennas for RHIC quadrupole magnets.** Ogitsu, T. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Terashima, A.; Tsuchiya, K.; Ganetis, G.; Muratore, J.; Wanderer, P. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–141: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011816. Source: OSTI; NTIS; INIS; GPO Dep.

Quench antennas for RHIC quadrupole magnets are being developed jointly by KEK and BNL. A quench antenna is a device to localize a quench origin using arrays of pick-up coils lined up along the magnet bore. Each array contains four pick-up coils: sensitive to normal sextupole, skew sextupole, normal octupole, and skew octupole field. This array configuration allows an azimuthal localization of a quench front while a series of arrays gives an axial localization and a quench propagation velocity. Several antennas have been developed for RHIC magnets and they are now routinely used for quench tests of production magnets. The paper discusses the description of the method and introduces a measured example using an antenna designed for quadrupole magnets.

24181 (BNL–61850) **Transition radiation electron beam diagnostic study at ATF.** Qiu, X.Z.; Wang, X.J.; Batchelor, K.; Ben-Zvi, I. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–163: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013232. Source: OSTI; NTIS; INIS; GPO Dep.

Recently we have started a program to develop transition radiation based electron beam diagnostics at the Accelerator Test Facility at Brookhaven National Laboratory. In this paper, we will discuss a technique to estimate the lower limit in electron beam divergence measurement with single foil transition radiation and two-foil transition radiation interferometer. Preliminary experimental data from 4.5 MeV electron beam will be presented.

24182 (BNL–61859) **ATF CO_2 laser system upgrade to terawatt peak power.** Pogorelsky, I.V. Brookhaven National Lab., Upton, NY (United States). May 1995. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95013592. Source: OSTI; NTIS; GPO Dep.

This document describes the proposed upgrade of the 10-GW peak power 50-ps CO_2 laser presently operational at the ATF to the 1 TW level at a shorter, 3–10 ps, pulse duration. The approach adopted is based on state of the art CO_2 laser technology and an experience gained in the course of the ATF laser design and application for the laser accelerator experiment. The proposed upgrade is an economical way for the ATF to become in a short time among leading users facilities available for next generation ($\geq$ 100 MeV) laser accelerator studies.

24183 (BNL–61920) **Hybrid helical snakes and rotators for RHIC.** Courant, E.D. Brookhaven National Lab., Upton, NY (United States). 13 Jun 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (AD/RHIC–133). Order Number DE95014551. Source: OSTI; NTIS; GPO Dep.

The spin rotators and Siberian snakes presently envisaged for RHIC utilize helical dipole magnets. The snakes and the rotators each consist of four helices, each with a full twist (360°) of the field. Here we investigate an alternate layout, namely combinations of helical and pure bending magnet, and show that this may have advantages.

24184 (CONF-661021–1) **Optimization criteria for standing wave transverse magnetic deflection cavities.** Haimson, J. (Massachusetts Institute of Technology, Cambridge, MA (United States)). Haimson Research Corp., Santa Clara, CA (United States). [1995]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-94ER81775. From Linear accelerator conference; Los Alamos, NM (United States); 3-7 Oct 1966. Order Number DE95016114. Source: OSTI; NTIS; GPO Dep.

An important linear accelerator requirement, in order to demonstrate narrow energy spectra, is the injection of electron bunches of narrow phase spread and negligible inter-bunch current. This can be achieved by r-f transverse modulation and clipping of the beam by an aperture prior to injection into the accelerator waveguide, i.e., chopper operation. By magnetically biasing the beam to one side of the centerline, it is possible to arrange for transmission into the accelerator at a time during each r-f cycle when the radial momentum imparted to the beam by the chopper cavity is passing through zero. The low efficiency of beam utilization normally associated with this type of operation, because of the high ratio of collected to transmitted current, can be considerably improved by combining the transverse chopping action with a suitably phased longitudinal velocity modulating field as obtained from a simple prebunching cavity. Transverse r-f deflection techniques also enable sub-harmonic bunch selection and injection into linear accelerators which are used as injectors for electron synchrotrons. This is achieved by driving the chopper cavity at the same frequency as the synchrotron r-f system (which is maintained at a precise submultiple of the linear accelerator fundamental frequency) and then prebunching the chopped beam at the fundamental frequency prior to injection into the linear accelerator.

24185 (FNAL/C–95/118) **Fermilab DART run control.** Oleynik, G. (and others); Engelfried, J.; Mengel, L. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950534–3: Conference on real-time computer applications in nuclear, particle and plasma physics (RT), East Lansing, MI (United States), 22-26 May 1995). Order Number DE95014662. Source: OSTI; NTIS; INIS; GPO Dep.

DART is the high speed, Unix based data acquisition system being developed by Fermilab in collaboration with seven High Energy Physics Experiments. This paper describes DART run control, which has been developed over the past year and is a flexible, distributed, extensible system for the, control and monitoring of the data acquisition systems. We discuss the unique and interesting concepts of the run control and some of our experiences in developing it. We also give a brief update and status of the whole DART system.

24186 (FNAL/C–95/143) **Flatcoil systems for measurements of Fermilab magnets.** Glass, H.D. (and others); Brown, B.C.; DiMarco, J. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950691–2: 14. international conference on magnet technology, Tampere (Finland), 11-16 Jun 1995). Order Number DE95014205. Source: OSTI; NTIS; GPO Dep.

A flux measurement system has been developed for measuring the integrated strength and relative shape of the magnetic field of Fermilab Main Injector dipoles. Improved field shape measurements have been obtained by constructing coil geometries which reduce the flux contribution from unwanted field derivatives. A bucking coil scheme employing reference coils in both the test magnet and a reference magnet reduce the sensitivity to power supply fluctuations. Design strategies for various measurement requirements are described, along with the details of implementing an assembly to measure curved 6 m and 4 m dipoles. Some representative results and comparison with redundant measurement systems are presented.

24187 (FNAL/C–95/170) **Design of a secondary-vertex trigger system.** Husby, D. (Fermi National Accelerator Lab., Batavia, IL (United States)); Chew, P.; Sterner, K.; Selove, W. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9505248–1: LeCroy conference on electronics for particle physics, Chestnut Ridge, NY (United States), May 1995). Order Number DE95014661. Source: OSTI; NTIS; INIS; GPO Dep.

For the selection of beauty and charm events with high efficiency at the Tevatron, a secondary-vertex trigger system is under design. It would operate on forward-geometry events. The system would use on-line tracking of all tracks in the vertex detector, to identify events with clearly detached secondary vertices.

24188 (FNAL-TM–1937) **Magnetic fields and scintillator performance.** Green, D. (Fermi National Accelerator Lab., Batavia, IL (United States)); Ronzhin, A.; Hagopian, V. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE95014659. Source: OSTI; NTIS; INIS; GPO Dep.

Experimental data have shown that the light output of a scintillator depends on the magnitude of the externally applied magnetic fields, and that this variation can affect the calorimeter calibration and possibly resolution. The goal of the measurements presented here is to study the light yield of scintillators in high magnetic fields in conditions that are similar to those anticipated for the LHC CMS detector. Two independent measurements were performed, the first at Fermilab and the second at the National High Magnetic Field Laboratory at Florida State University.

24189 (JINR-D–9-92-455, pp. 58-59) **Control system of high-current resonance electron linac for radiation technologies.** Ajzatskij, N.I. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)); Akchurin, Yu.I.; Bakhmet'ev, N.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The on-line control system of the 8 - 10 MeV resonance electron accelerator having beam average power of 2 kw is described. The on-line control system consists of the P C/AT-286 computer equipped with the CAMAC data way, microprocessor complex controlling klystron amplifier, thermostatic system, synchronization unit and a set of equipment interfaces. The program package providing accelerator control is being developed using the Si programming language. 1 ref., 2 figs.

24190 (JINR-D–9-92-455, pp. 60-62) **Automated control system of the MKM-21 multipurpose microtron.** Alekseev, I.V. (Saratovskij Gosudarstvennyj Univ., Saratov (Russian Federation)); Balaev, A.Yu.; Vishnevskij, A.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

On-line control system of the MKM-21 multipurpose microtron having beam current of 10 - 20 μA and energy of 14 - 21 MeV is described. Manual operation and on-line regimes are foreseen in the system. The equipment interface provides the communication between the radiator, power supply, the manual control console and the computer. The interface comprises 64-channel, 16-bit parallel interface and is manufactured on the base of microcircuits. The console has widely-developed system of visual control of accidents and operation condition of the main accelerator systems. The major parameters of the accelerator are given. 2 figs., 1 tab.

24191 (JINR-D–9-92-455, pp. 63-66) **Fast monitoring and control system of two-dimensional current distribution along proton beam profile.** Tron', A.M. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The system designed for operative measurement and control of two-dimensional current distribution along proton beam cross-section of the Moscow meson factory is described. The principle of operation of beam monitor consists of measuring two-dimensional distribution of secondary electrons produced in interaction of controlling beam with a set of thin emitters which are 10 μm tantalum foil strips. The control system comprises 64-channel analog signal commutator with an integrator at the input, power supply units, the CAMAC on-line measurement and control system and the IBM P C/286 microcomputer. 6 refs., 5 figs.

24192 (JINR-D–9-92-455, pp. 67-73) **Precise drive for the electron-positron linear collider elements positioning system.** Balakin, V.E. (RAN Sibirskoe Otdelenie, Inst Yadernoj Fiziki im. G.I.Budkera, Novosibirsk (Russian Federation)); Valyaev, Yu.D.; Kolmagorov, A.V.; Krasnonosen'kikh, D.P.; Leont'evskaya, L.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The drive designed for linear collider elements positioning and stabilization is described and basic characteristics of the system are given. The positioning accuracy equals 1 nm. The scheme of beam position monitor is presented. The beam monitor is an alternating voltage induction engine. 6 figs.

24193 (JINR-D–9-92-455, pp. 74-77) **Programming of applied problems in the ITEP accelerating complex control system.** Alekseev, N.N. (Inst Teoreticheskoj i Ehksperimental'noj Fiziki, Moscow (Russian Federation)); Rybakov, A.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The concept of organization of software of the ITEP accelerator complex distributed control system is described. Software and hardware have modular structure and may be modified according to operating conditions and problems to be solved. The problem of orbit correction in the U-70 is considered as an example. 7 refs.

24194 (JINR-D–9-92-455, pp. 93-98) **Precise measurement of electromagnetic fields in accelerating structures.** Vorogushin, M.F. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Chernogubovskij, M.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Electron-optical technique of measurement of spatial distribution of electromagnetic field in cavity resonators of accelerating structures is suggested. The given technique allows one to reduce errors due to perturbed body displacement device, to fix field axial asymmetry with the accuracy of micrometer units. Application of the balance method (where actual read-out of field values is absent) for structures with quadrupole focusing at a frequency of 433 MHz provides the determination efficiency and modulation period accuracy within units and fraction of percents. 3 refs., 1 fig.

24195 (JINR-D–9-92-455, pp. 99-101) **Multifunctional measuring device of linear collider beam transverse parameters.** Shestak, V.P. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Possibilities of using an electron-beam probing method for measuring electron and positron beams profiles and position in linear collider are investigated. It is shown that application of a microchannel electron multiplier which resolution is 20×10^{-6} m as a position sensitive detector and an ion beam as a monitor makes it possible to attain the resolution of 2×10^{-8} m within the bunch. 5 refs., 1 fig.

24196 (JINR-D–9-92-455, pp. 102-104) **On-line measurement system for detailed investigation of evolution of the MMF linear accelerator beam parameters.** Bragin, C.E. (RAN, Inst Yadernykh Issledovanij, Moscow (Russian Federation)); Il'inskij, N.G.; Mirzoyan, A.N.; Rejngardt-Nikulin, P.I.; Senichev, Yu.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The description and test results of the on-line system designed for measuring Moscow meson factory proton beam parameters are presented. It is shown, that using calibration tables the beam profile restoration accuracy of $\approx$ 2 - 3%. Results of investigating the profile evolution of 750 keV beam showed the beam center displacement in the transport channel attaining the order of 1 mm. 4 refs., 3 figs.

24197 (JINR-D–9-92-455, pp. 112-115) **U-400 M cyclotron magnetic deflectors based beam extraction system.** Akishin, P.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Borisov, O.N.; Gul'bekyan, G.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Calculation results of the system designed for ion beam extraction from the U-400 M isochronous cyclotron are presented. The design of magnetic deflectors is described and magnetic field distribution in deflectors are shown. The first deflector is used for beam deflection and the rest of them are used for beam shaping during beam transport up to the beam transport system. 3 refs., 2 tabs., 6 figs.

24198 (JINR-D–9-92-455, pp. 116-117) **Ion beam extraction from the U-400 M cyclotron using charge exchange.** Borisov, O.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Gul'bekyan, G.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Calculation results of ion beam extraction from the U-400M cyclotron by means of ion charge exchange on a foil are presented. The given technique allows the extraction of practically full beam, moreover, it is possible to attain higher intensity at the expanse of the increase of accelerating beam phase range up to 40 deg. 5 refs., 3 figs.

24199 (JINR-D–9-92-455, pp. 142-146) **Separation channel of radioactive nuclei.** Kapustin, A.A. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Kokorin, A.M.; Mud'yugin, B.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The scheme of an ion-optical channel (IOCh) based on the U-240 cyclotron is considered. The IOCh is designed for the production of radioactive nuclei having high intensity and high degree of separation from background nuclei. Two-stage scheme comprising an analyzing magnet and an electrostatic separator is used for separating main isotopes nuclei. The IOCh provides ion transport with angular $\pm$ 1 deg and momentum spread of $\pm$ 2%. The transport channel with analyzing magnet designed for cyclotron beam

monochromatization is used as a first stage for separating some radioactive nuclei. 3 figs.

24200 (JINR-D–9-92-455, pp. 150-152) **Polarized ion injection into the U-120 cyclotron.** Olejnik, E.E. (Akademiya Nauk Ukrainy, Inst Yadernykh Issledovanij, Kiev (Ukraine)); Bezruk, A.I.; Bykov, V.I.; Grantsev, V.I.; Magal', M.I.; Pashin, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of calculation of a channel designed for polarized ion injection into the U-120 cyclotron are presented. Calculations based on using the TRANSPORT computer code showed the possibility of polarized beam transport without application of the Win's filter. For the given case the value of beam polarization degree for the central trajectory practically coincides with the initial one. 2 refs., 1 fig.

24201 (JINR-D–9-92-455, pp. 173-177) **Experimental study on a cm-wave range power pulse magnicon.** Zapryagaev, I.A. (RAN Sibirskoe Otdelenie, Inst Yadernoj Fiziki im. G.I.Budkera, Novosibirsk (Russian Federation)); Kazarezov, I.V.; Kozyrev, E.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The description and test results of a cm-wave range power pulse microwave source-magnicon-frequency doubler designed for an electron gun of a linear collider are presented. In the given scheme of the magnicon the gap which is free from guiding magnetic field between the output resonator and the scanner is absent. Magnetic system is an armour solenoid comprising eight similar water-cooled coils. 3 refs., 2 tabs., 2 figs.

24202 (JINR-D–9-92-455, pp. 178-182) **Development and performance testing of elements of power RF systems of linear electron-positron colliders.** Avrakhov, P.V. (RAN Sibirskoe Otdelenie, Inst Yadernoj Fiziki im. G.I.Budkera, Novosibirsk (Russian Federation)); Adarich, I.N.; Arapov, L.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The description of a five-meter module of a linear accelerator designed for a linear collider which is under development is presented. Test results of separate systems of the module are given. 9 refs., 1 tab., 4 figs.

24203 (JINR-D–9-92-455, pp. 183-186) **Performance testing of RF system elements of a racetrack microtron recuperator.** Arbuzov, V.S. (Zavod 'Komsomolets', Tambov (Russian Federation)); Belomestnykh, S.A.; Bushuev, A.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The racetrack microtron - the continuous action recuperator designed for a free-electron laser is under development in the Novosibirsk Institute for Nuclear Physics. The designed electron energy is 45 MeV, average beam current is 0.1 A. 21 resonators (with peak accelerating voltage of 800 kw and RF-generators with total power of about 2 MW) are planned to be applied in the microtron RF-systems. Accelerating cavity resonator and the 181 MHz RF-generator cascades have been developed and tested at a high power level and the steady-state conditions of operation. 4 refs., 1 tab., 2 figs.

24204 (JINR-D–9-92-455, pp. 195-200) **Present status on superconducting cavity resonators at the Institute for High Energy Physics.** Sevryukova, L.M. (Institut Fiziki Vysokikh Ehnergij, Protvino (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The main directions and results of investigating the development and the fabrication of superconducting cavity resonators for the IHEP charged particle accelerators are outlined in brief. The description of technological equipment designed for investigating superconducting cavity resonators is presented. 8 refs.

24205 (JINR-D–9-92-455, pp. 201-204) **Regotron - powerful RF generator with distributed power takeoff system.** Murin, B.P. (RAN, Moskovskij Radiotekhnicheskij Inst, Moscow (Russian Federation)); Bondarev, B.I.; Durkin, A.P.; Shlygin, O.Yu.; Shumakov, I.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The high-power 'Regotron'-type microwave generator providing the production of 5 - 10 MW power in continuous mode of operation with efficiency of 70 - 60% is described. The expediency of using the 'Regotron' for supplying the high-power accelerator with high average beam current designed for operation as a barn-reactor to solve the problem of transmutation of long-lived radionuclides formed during nuclear power plant operation is shown. The characteristics of the 'Regotron' operating at a frequency of 991 MHz are presented. 5 refs., 1 tab., 2 figs.

24206 (JINR-D–9-92-455, pp. 205-207) **New modifications of corrugated waveguides for acceleration of short-pulse electron beams.** Ajzatskij, N.I. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)); Biller, E.Z.; Dovbnya, A.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The structure of corrugated waveguides where one of the travelling wave spatial harmonic is in a synchronism with charged particles is described. The given structure is designed for a short-pulse accelerator with total charge in electron bunch of 500 nC. Modifications of these structures are described. Results of performance testing of accelerating sections based on these structures are given. 4 refs.

24207 (JINR-D–9-92-455, pp. 208-211) **Project of RF-system for the TsPR-144 cyclotron for applied purposes.** Sakhno, V.I. (Inst Yadernykh Issledovanij Ukrainy, Kiev (Ukraine)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The description of a three-resonator RF-system of the TsPR-144 cyclotron designed for applied purposes is given. An accelerating section comprising an RF valve oscillator with the self-excitation and a cavity resonator is the base element of the system. Three accelerating sections are designed for the acceleration rate of up to 0.3 MeV/revolution. 7 refs., 2 figs.

24208 (JINR-D–9-92-455, pp. 212-215) **Status on batch production of VLEhPP accelerating sections.** Balakin, V.E. (RAN Sibirskoe Otdelenie, Filial Instituta Yadernoj Fiziki im. G.I.Budkera, Protvino (Russian Federation)); Solyak, N.A.; Arapov, L.N.; Gosteev, V.K.; Dolgashev, V.A.; Kosarev, A.N.; Kuklin, D.E.; Minkov, A.V.; Shemelin, V.D.; Manokhin, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian).

(CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Status of the industrial production of linear collider accelerating sections with operating frequency of 14 GHz and acceleration rate of 100 MeV/m is described. Requirements for the accuracy of manufacturing of accelerating sections are determined. The shaping lathe is developed. The technology of section connection is found. 4 refs., 2 figs.

24209 (JINR-D–9-92-455, pp. 216-218) **Tuning of transition cells of piece-homogeneous accelerating structures.** Ajzatskij, N.I. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)); Biller, E.Z.; Dovbnya, A.N.; Kushnir, V.A.; Mitrochenko, V.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of theoretical study on characteristics of different methods of matching corrugated piece-uniform waveguide accelerating structures are presented. It is shown, that the length of symmetrical matching cells must be equal to $\lambda/4$. When using nonsymmetric transition cells, their tuning must be performed for their inner diameter. 9 refs.

24210 (JINR-D–9-92-455, pp. 219-222) **Study on beam instability in 10 cm power klystron amplifiers.** Balakin, V.E. (RAN Sibirskoe Otdelenie, Filial Instituta Yadernoj Fiziki im. G.I.Budkera, Protvino (Russian Federation)); Teryaev, V.E.; Chashurin, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of experimental study on parameters of microwave power supplies of electron linacs are presented. It is shown that the effect of RF-signal shortening is due to beam break-up in the beam bunching system which is the consequence of beam resonance interaction with nonsymmetric waves exciting in the system at the frequency range of 5.4 GHz. 5 refs., 3 figs.

24211 (JINR-D–9-92-455, pp. 223-225) **Influence of longitudinal focusing magnetic field direction on klystron output power.** Moiseev, V.I. (Rossijskij Nauchnyj Tsentr Kurchatovskij Inst, Moscow (Russian Federation)); Petrenko, V.V.; Smirnov, V.N.; Berezhnoj, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The study on microwave field axial asymmetry introduced by a coupling element in the klystron resonators is done. It is shown, that focusing magnetic field should be optimized both in the value, and in its direction during klystron tuning for the operation made. 1 ref.

24212 (JINR-D–9-92-455, pp. 226-227) **SHF-power supply auto generator system of a small-sized sector microtron (project).** Vladimirov, N.V. (Saratovskij Gosudarstvennyj Univ, Saratov (Russian Federation)); Gorbachev, V.P.; Stepanchuk, V.P.; Spirin, L.A.; Sherudilo, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Status of the development of an auto generator system of an RF-power supply of a sector microtron with an accelerating structure in a feedback circuit is described. The auto generator system comprises the matched load, the accelerating structure, the waveguide tee, the amplitron and the short-circuit plunger. The designed over dimensions of the system are as follows: 0.8 x 0.6 x 0.5 m. 1 ref., 1 fig.

24213 (JINR-D–9-92-455, pp. 228-231) **Investigations of superconducting resonators at the Institute for Nuclear Research RAN.** Balitskij, V.A. (RAN, Inst Yadernykh Issledovanij, Troitsk (Russian Federation)); Berezhnoj, V.A.; Gorbul', V.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the calculation of electrodynamic characteristics of superconducting resonators and higher-type oscillations dampers designed for electron linacs are presented. Estimated values necessary for resonator tuning for operation frequency are given. The first stage of the development of a superconducting resonator cryogenic system is described. The estimated length of a cooling structure is 0.7 m. 5 refs., 1 fig.

24214 (JINR-D–9-92-455, pp. 232-235) **On thermal stability of superconducting resonator.** Kurakin, V.G. (Fizicheskij Inst im. P.N.Lebedeva, Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

An attempt to solve the analytical problem of superconducting resonator thermal stability is made. The instability criteria are obtained using the joint solution of the heat conduction equation and the resonator excitation equation in the framework of a linear approximation. 9 refs.

24215 (JINR-D–9-92-455, pp. 236-238) **Complex of equipment for manufacturing and treatment of Nb/Cu based superconducting resonators.** Alimov, V.V. (Institut Fiziki Vysokikh Ehnergij, Protvino (Russian Federation)); Romamenko, V.E.; Sevryukova, L.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The technology of the fabrication of superconducting resonators on the base of copper matrices free from welded joints obtained using galvanoplastic molding with the following niobium coating applied by means of magnetron sputtering is described. 3 refs., 4 figs.

24216 (JINR-D–9-92-455, pp. 239-241) **Methods of technological control during manufacturing of superconducting resonators.** Bazhenov, A.V. (Institut Fiziki Vysokikh Ehnergij, Protvino (Russian Federation)); Matveeva, O.V.; Pesterev, S.M.; Sevryukova, L.M.; Shapovalov, Yu.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Methods of technological control during manufacturing and processing superconducting resonators are described. Acoustic emission method is used for the control of copper matrices fabrication. 8 refs.

24217 (JINR-D–9-92-455, pp. 242-244) **Superconducting acceleration RF-structure with longitudinal detachable joints.** Sokolov, B.A. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged*

particle accelerators. Volume 1. Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The design variant of a three-sector superconducting RF-structure with longitudinal detachable joints is described. The structure comprises one top sector and two side sectors with autonomous helium baths separated with vacuum gaps. The structure is placed in a high-vacuum container placed on the supports. The possibility of the increase of limiting current of a charged particle beam accelerated at the given structures is shown. The variation of the gap size between sectors allows on to perform coarse tuning of the structure and there is the possibility of direct access to working surface. 5 refs., 3 figs.

24218 (JINR-D–9-92-455, pp. 245-248) **Coefficient of a field over intensity on the surface of a corrugated waveguide.** Ermilov, Eh.A. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (Russian Federation)); Shchedrin, I.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Calculations of the electric field maximum intensity on the surface of a ring corrugated waveguide to the main field harmonic on the waveguide axis ratios for different types of oscillations have been conducted. The obtained data are supposed to be used in the construction of compact accelerating structures. 3 refs., 2 figs.

24219 (JINR-D–9-92-455, pp. 249-251) **Combined accelerating structure with optimized multi resonator buncher.** Vakhrushin, Yu.P. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Ryabtsev, A.V.; Smirnov, V.L.; Terent'ev, V.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The combined accelerating structure comprising a multi resonator beam buncher where more than of 70% of injected particles are trapped into accelerating mode is described. The initial part (resonator substructure) of the system operates in a standing wave mode; the final part (waveguide substructure) operates in the travelling wave mode. The beam buncher is a section of resonator structure with coaxial coupling cells. Parameters of the optimized four-gap beam buncher are given. 6 refs., 1 tab., 2 figs.

24220 (JINR-D–9-92-455, pp. 252-257) **TRANSI - the program for calculation of transient processes in inhomogeneous accelerating structures.** Orlov, A.K. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the calculation of transient processes arising in inhomogeneous accelerating structures are presented. Biperiodic electrodynamic chain which is coupling resonators with the proper frequency, the effective shunt resistance and the Q - factor comprising an accelerating gap and which are separated with a drift gap is considered. Time variation of accelerated particle spectra is shown. 5 refs., 1 fig.

24221 (JINR-D–9-92-455, pp. 269-273) **Investigation of multipactoring discharge in an H-type resonator of an ion linac.** Lobzev, L.D. (UNTs Khar'kovskogo Fiziko-Tekhnicheskogo Instituta, Kharkov (Ukraine)); Mazalov, Yu.P.; Gusev, E.V.; Shulika, N.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The study on the variation of parameters of an auto generator power supply of an ion linear accelerator which is under construction on the base of the H-type resonator with drift tube comb mounts has been made. The main attention was paid to investigating multipactor discharges. It is concluded, that presence of secondary autonomous self-oscillation circuit providing the field rise with the frequency close to operation frequency leads to the decrease of multipactor discharge intensity level, which is enough for the elimination of their harmful effect on accelerator steady-state performance. 8 refs., 3 figs.

24222 (JINR-D–9-92-455, pp. 280-281) **Excitation of coaxial sections of a waveguide structure.** Golubykh, S.M. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The analytical solution of the problem of excitation of coaxial sections of an accelerator waveguide structure is obtained. 1 ref., 1 fig.

24223 (JINR-D–9-92-455, pp. 293-296) **Accelerating resonators with mechanical frequency tuning.** Vodop'yanov, F.A. (RAN, Moskovskij Radiotekhnicheskij Inst, Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The possibility of mechanical frequency tuning of the narrow frequency range accelerating resonators is investigated. Some examples are shown. Resonators with mechanical frequency tuning have higher Q-factor to compare with ferrite resonators, are chipper in manufacturing and have much long life. The designed accuracy of proper frequency variation in the chain of a large number of resonators may be attained by means of supplying them with the fast trimming tabs.

24224 (JINR-D–9-92-455, pp. 303-304) **Optimization of algorithms for calculating magnetic fields of iron-free magnetic systems.** Zhidkov, E.P. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Egikyan, R.S.; Merkulov, L.A.; Nikonov, Eh.G.; Yudin, I.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The modified variant of a computer code designed for calculating the 'STORS' toroidal spectrometer superconducting magnet field is described. In the given method the optimal conditions are fulfilled for the 20 - 25 numbers of the curved sections, thus the counting rate increase of 8 - 9 times is obtained in the comparison with other methods. 2 refs., 1 fig.

24225 (JINR-D–9-92-455, pp. 309-313) **High-voltage pulse generator based on inductive-coupled circuits.** Sidorov, A.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

A new scheme of a high-voltage pulse two-stage L C-generator is suggested. The novelty in generator scheme is the possibility of simultaneous power gain with the increase of output voltage. At charging voltage of 11 kV the output voltage is 43 kV and power amplification factor is 5. 5 refs., 5 figs.

24226 (JINR-D–9-92-455, pp. 314-319) **Magnets of large-aperture spectrometer KOMBAS.** Anan'ev, S.M. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Kashikhin, V.S.; Lamzin, E.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The design study of the KOMBAS large-aperture spectrometer two-sectional magnetic system has been carried out. The KOMBAS spectrometer is intended for experiments with heavy ion beams accelerated at the U-400 and U-400M cyclotrons. Each section comprises two bending magnets and two correction magnets. 3 refs., 4 figs.

24227 (JINR-D–9-92-455, pp. 320-325) **Calculation of an vacuum system of an accelerator of H^- ion intense beams.** Olejnik, E.E. (AN Ukrainy, Inst Yademykh Issledovanij, Kiev (Ukraine)); Bykov, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the calculation of the TsPR-144 isochronous cyclotron vacuum system are presented. The cyclotron is designed for the acceleration of H^- intense beams vacuum parameters of the chamber are given. The main requirements for producing the vacuum chamber are determined. The design losses at the radius of 0.6 m is $\approx$ 5%. 5 refs., 2 tabs., 2 figs.

24228 (JINR-D–9-92-455, pp. 326-329) **Inductive energy storage based high-voltage power supply system of an electron linac.** Muratov, A.V. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Solov'ev, Yu.V.; Ehrmel', V.Eh. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The scheme of an inductive energy storage based on a thyristor and designed for charging electron linac shaping line is developed. The energy storage allows to improve overall dimensions of electron linac power supplies at the expanse of expelling large-size power transformers. It is shown that one may that one may construct the equipment with average power of up to 40 kw on the base of one thyristor switch. 1 ref., 3 figs.

24229 (JINR-D–9-92-455, pp. 330-333) **Analysis of field harmonics of rectangular aperture magnets.** Dojnikov, N.I. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Sychevskij, S.E.; Chirkov, A.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Rectangular aperture magnet field harmonics analysis has been carried out with the FOURIE computer code with the aim of the verification of the obtained results their faith fullness to some particular cases of dipole, quadrupole and sextupole fields is established. 4 refs., 2 figs.

24230 (JINR-D–9-92-455, pp. 334-338) **Charge exchange injection system kicker magnets pulse power supply.** Goncharenko, V.P. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Lebedev, A.P.; Fedorov, V.D. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The scheme of a power supply system of a charge-exchange injection system kicker magnets is described. Current pulse rise formation is performed at resonance discharge of a reservoir capacitor; flat-top current stability is provided by means of a compensation source having high capacitance which $\geq$ 1.2 F of an output capacitor; the formation of pulse trailing edge is provided with the introduction of artificial series-inductive switching of the principal thyristor. Power supply design is the 'Vishnya' type two frames having overall dimensions of 600 x 700 x 200 mm each. 3 figs.

24231 (JINR-D–9-92-455, pp. 339-341) **Compression chain with prepulse compensation.** Sidorov, A.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The scheme of a pulse power amplification chain with the prepulse compensation is described. The prepulse compensation device can be applied both in conventional compression chains and in compression chains with a transformer. 3 refs., 3 figs.

24232 (JINR-D–9-92-455, pp. 345-347) **Direct current stabilizers for supplying magnet coils of iron-core current channel of the JINR phasotron.** Denisov, Yu.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Kazakova, G.G.; Kalinichenko, V.V.; Solomnikov, V.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Direct current stabilizers designed for the JINR phasotron iron-current channel power supply are described. Stabilizers provide current instability and pulsations being $\approx 10^{-3}$ in the range of current variation of 7.5 - 12.2 kA and 3.0 - 3.2 kA correspondingly. The stabilizer scheme comprises a constant voltage auto modulation comparator. 10 refs., 3 figs.

24233 (JINR-D–9-92-455, pp. 348-351) **Magnetic system of the U-115T isochronous cyclotron.** Alenitskij, Yu.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Zaplatin, N.L.; Samsonov, E.V.; Chesnov, A.F.; Chesnova, S.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The four-spiral magnetic system of the U-115T isochronous cyclotron designed for the isotope production during irradiating internal targets with 200 MeV, 200 μA accelerated proton beam is described. Magnetic field in the central region is formed by means of an annular shim having internal and external radii of 7.2 and 11 mm correspondingly. Magnetic system parameters are given. 5 refs., 2 tabs., 5 figs.

24234 (JINR-D–9-92-455, pp. 352-360) **Application of ceramics, dielectric coatings and insulation materials in magnetic circuits structures of magnet coils.** Antipov, V.F. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Nesterenko, V.M.; Severgin, Yu.P.; Filimonov, M.Z. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Nitride group ceramics materials are analyzed and suggested as the intra coil insulation for electromagnetic coils based on silicon nitride and aluminium oxide. Metallic solders for copper bus structural elements connection are chosen. The electrical strength tests of functional samples of coils with selected insulation materials have been made. 1 tab. 1 fig.

24235 (LA-UR–95-1385) **Subpicosecond, ultra-bright electron injector.** Carlsten, B.E. (and others); Milder, M.L.; Kinross-Wright, J. Los Alamos National Lab., NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–237: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014012. Source: OSTI; NTIS; GPO Dep.

We have designed and are building a subpicosecond electron injector. The injector is based on a 7.5 MeV photoinjector, used previously at Los Alamos in the APEX experiment. The nominal design includes magnetically compressing a 20 ps long, 3 nC bunch to a FWHM bunch length of 2/3 ps (peak current in excess of 3 kA) using a four dipole chicane buncher. The geometrial averaged transverse normalized transverse emittance after compression is about 15 ir mm mrad.

24236 (LA-UR–95-1386) **Phase-stable, microwave FEL amplifier.** Carlsten, B.E. (Los Alamos National Lab., NM (United States)); Fazio, M.V.; Haynes, W.B.; May, L.; Potter, M. Los Alamos National Lab., NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–238: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014011. Source: OSTI; NTIS; GPO Dep.

Free-electron laser (FEL) amplifiers have demonstrated high efficiency and high output power for microwave wavelengths. However, using present technology, microwave FEL amplifiers are not phase stable enough to be suitable for driving linear accelerators, where several much amplifiers need to be phase locked. The growing wave's phase sensitivity to the beam voltage in the small-signal gain regime is responsible for the largest contribution to this phase instability. We discuss a scheme that reduces the phase sensitivity to the beam voltage by operating off synchronism and matching the phase variation resulting from the desynchronism to the phase variation from the reduced plasma wavenumber as the beam voltage changes.

24237 (LBL–36459) **Engineering conceptual design of the relativistic Klystron two-beam accelerator based power source for 1-TeV next linear collider.** Reginato, L.; Deadrick, F.; Peters, C.; Vanecek, D.; Yu, S. Lawrence Berkeley Lab., CA (United States). Apr 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950512–260: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014870. Source: OSTI; NTIS; INIS; GPO Dep.

Ultra-high gradient radio frequency linacs require efficient and reliable power sources. The induction linac has proven to be a reliable source of low energy, high current and high brightness electron beams. The low energy beam is bunched, transported through resonant transfer cavities in which it radiates microwave energy that is coupled to an adjacent high energy accelerator. The low energy beam is maintained at a constant energy by periodic induction accelerator cells. This paper describes the engineering aspects of the induction accelerator based relativistic klystron. The physics issues are covered in another paper at this conference.

24238 (LBL-PUB–754, pp. 19-28) **BIG KARL and COSY: Examples for high performance magnet design taught by "Papa Klaus".** Bechtstedt, U. (Institut fuer Kernphysik, Juelich (Germany)); Hacker, U.; Maier, R.; Martin, S.; Berg, G.P.A.; Hardt, A.; Huerlimann, W.; Meissburger, J.; Roemer, J.G.M. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

The past decades have seen a tremendous development in nuclear, middle, and high energy physics. This advance was in a great part promoted by the availability of newer and more powerful instruments. Over time, these instruments grew in size as well as in sophistication and precision. Nearly all these devices had one fundamental thing in common - magnetic fields produced with currents and iron. The precision demanded by the new experiments and machines did bring the magnet technology to new frontiers requiring the utmost in the accuracy of magnetic fields. The complex properties of the iron challenged innumerable physicists in the attempt to force the magnetic fields into the desired shape. Experience and analytical insight were the pillars for coping with those problems and only few mastered the skills and were in addition able to communicate their intricate knowledge. It was a fortuitous situation that the authors got to know Klaus Halbach who belonged to those few and who shared his knowledge contributing thus largely to the successful completion of two large instruments that were built at the Forschungszentrum Juelich, KFA, for nuclear and middle energy physics. In one case the efforts went to the large spectrometer named BIG KARL whose design phase started in the early 70's. In the second case the work started in the early 80's with the task to build a high precision 2.5 GeV proton accelerator for cooled stored and extracted beams known as COSY-Juelich.

24239 (LBL-PUB–754, pp. 29-37) **Calculated and measured fields in superferric wiggler magnets.** Blum, E.B. (Brookhaven National Lab., Upton, NY (United States)); Solomon, L. Lawrence Berkeley Lab., CA (United States). Feb 1995. DOE Contract AC02-76CH00016. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

Although Klaus Halbach is widely known and appreciated as the originator of the computer program POISSON for electromagnetic field calculation, Klaus has always believed that analytical methods can give much more insight into the performance of a magnet than numerical simulation. Analytical approximations readily show how the different aspects of a magnet's design such as pole dimensions, current, and coil configuration contribute to the performance. These methods yield accuracies of better than 10%. Analytical methods should therefore be used when conceptualizing a magnet design. Computer analysis can then be used for refinement. A simple model is presented for the peak on-axis field of an electromagnetic wiggler with iron poles and superconducting coils. The model is applied to the radiator section of the superconducting wiggler for the BNL Harmonic Generation Free Electron Laser. The predictions of the model are compared to the measured field and the results from POISSON.

24240 (LBL-PUB–754, pp. 39-44) **Comparison of conventional and novel quadrupole drift tube magnets inspired by Klaus Halbach.** Feinberg, B. (Lawrence Berkeley Lab., CA (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

Quadrupole drift tube magnets for a heavy-ion linac provide a demanding application of magnet technology. A comparison is made of three different solutions to the problem of providing an adjustable high-field-strength quadrupole magnet in a small volume. A conventional tape-wound electromagnet quadrupole magnet (conventional) is compared with an adjustable permanent-magnet/iron quadrupole magnet (hybrid) and a laced permanent-magnet/iron/electromagnet (laced). Data is presented from magnets constructed for the SuperHILAC heavy-ion linear accelerator, and conclusions are drawn for various applications.

24241 (LBL-PUB–754, pp. 45-50) **Concept of quasi-periodic undulator - control of radiation spectrum.** Sasaki, Shigemi (Japan Atomic Energy Research Institute, Ibaraki (Japan)). Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

A new type of undulator, the quasi-periodic undulator (QPU) is considered which generates the irrational harmonics in the radiation spectrum. This undulator consists of the arrays of magnet blocks aligned in a quasi-periodic order, and consequentially lead to a quasi-periodic motion of electron. A combination of the QPU and a conventional crystal/grating monochromator provides pure

monochromatic photon beam for synchrotron radiation users because the irrational harmonics do not be diffracted in the same direction by a monochromator. The radiation power and width of each radiation peak emitted from this undulator are expected to be comparable with those of the conventional periodic undulator.

24242 (LBL-PUB–754, pp. 55-63) **Field errors in hybrid insertion devices.** Schlueter, R.D. (Lawrence Berkeley Lab., CA (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. DOE Contract AC03-76SF00098. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

Hybrid magnet theory as applied to the error analyses used in the design of Advanced Light Source (ALS) insertion devices is reviewed. Sources of field errors in hybrid insertion devices are discussed.

24243 (LBL-PUB–754, pp. 65-73) **Field of a helical Siberian Snake.** Luccio, A. (Brookhaven National Lab., Upton, NY (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

To preserve the spin polarization of a beam of high energy protons in a circular accelerator, magnets with periodic magnetic field, called Siberian Snakes are being used. Recently, it was proposed to build Siberian Snakes with superconducting helical dipoles. In a helical, or twisted dipole, the magnetic field is perpendicular to the axis of the helix and rotates around it as one proceeds along the magnet. In an engineering study of a 4 Tesla helical snake, the coil geometry is derived, by twisting, from the geometry of a cosine superconducting dipole. While waiting for magnetic measurement data on such a prototype, an analytical expression for the field of the helice is important, to calculate the particle trajectories and the spin precession in the helix. This model will also allow to determine the optical characteristics of the snake, as an insertion in the lattice of the accelerator. In particular, one can calculate the integrated multipoles through the magnet and the equivalent transfer matrix. An expression for the field in the helix body, i.e., excluding the fringe field was given in a classical paper. An alternate expression can be found by elaborating on the treatment of the field of a transverse wiggler obtained under the rather general conditions that the variables are separable. This expression exactly satisfies Maxwell's div and curl equations for a stationary field, $\nabla \cdot B = 0$, $\nabla \times B = 0$. This approach is useful in that it will allow one to use much of the work already done on the problem of inserting wigglers and undulators in the lattice of a circular accelerator.

24244 (LBL-PUB–754, pp. 121-133) **Insertion device calculations with mathematica.** Carr, R. (Stanford Synchrotron Radiation Lab., CA (United States)); Lidia, S. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

The design of accelerator insertion devices such as wigglers and undulators has usually been aided by numerical modeling on digital computers, using code in high level languages like Fortran. In the present era, there are higher level programming environments like IDL®, MatLab®, and Mathematica® in which these calculations may be performed by writing much less code, and in which standard mathematical techniques are very easily used. The authors present a suite of standard insertion device modeling routines in Mathematica to illustrate the new techniques. These routines include a simple way to generate magnetic fields using blocks of CSEM materials, trajectory solutions from the Lorentz force equations for given magnetic fields, Bessel function calculations of radiation for wigglers and undulators and general radiation calculations for undulators.

24245 (LBL-PUB–754, pp. 137-141) **Low-field permanent magnet quadrupoles in a new relativistic-klystron two-beam accelerator design.** Yu, S. (Lawrence Berkeley Lab., CA (United States)); Sessler, A. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

Permanent magnets play a central role in the new relativistic klystron two-beam-accelerator design. The two key goals of this new design, low cost and the suppression of beam break-up instability are both intimately tied to the permanent magnet quadrupole focusing system. A recently completed systems study by a joint LBL-LLNL team concludes that a power source for a 1 TeV center-of-mass Next Linear Collider based on the new TBA design can be as low as $1 billion, and the efficiency (wall plug to rf) is estimated to be 36%. End-to-end simulations of longitudinal and transverse beam dynamics show that the drive beam is stable over the entire TBA unit.

24246 (LBL-PUB–754, pp. 161-173) **Operation of a small-gap undulator on the NSLS X-ray Ring.** Stefan, P.M. (Brookhaven National Lab., Upton, NY (United States)); Krinsky, S.; Rakowsky, G.; Solomon, L. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

The authors report results of an on-going experiment being carried out in the X13 straight section of the NSLS X-ray Ring which explores the limits of the operation of small-gap undulators. In particular, they discuss the operation of a 16 mm period small-gap undulator. At an electron beam current of 300 mA the variable gap vacuum chamber has been closed to an inner aperture of 3.8 mm with no effect on the electron beam lifetime. Measurements of the output radiation spectrum at a magnet gap of 7.5 mm are described.

24247 (LBL-PUB–754, pp. 253-256) **The first insertion devices at SSRL - some personal recollections.** Winick, H. (Stanford Linear Accelerator Center, CA (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

The author recounts his experiences with insertion devices at the Stanford Synchrotron Radiation Laboratory. His first experiences with wigglers occured at the Cambridge Electron Accelerator, and was carried over to SSRL with the proposal for a six pole electromagnetic wiggler. Most modern undulators, and many wigglers are now designed around permanent magnets, and the origin of this transition at SSRL was rather fortuitous and humorous. It reflects some of the personality characteristics of Klaus Halbach.

24248 (LBL-PUB–754, pp. 265-273) **Transition undulator radiation as bright infrared sources.** Kim, K.J. (Lawrence Berkeley Lab., CA (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

Undulator radiation contains, in addition to the usual component with narrow spectral features, a broad-band component in the low frequency region emitted in the near forward direction, peaked at an angle $1/\gamma$, where γ is the relativistic factor. This component is referred to as the transition undulator radiation, as it is caused by the sudden change in the electron's longitudinal velocity as it enters and leaves the undulator. The characteristic of the transition undulator radiation are analyzed and compared with the infrared radiation from the usual undulator harmonics and from bending magnets.

24249 (LBL-PUB–754, pp. 275-285) **Use of the Halbach perturbation theory for the multipole design of the ALS storage ring sextupole.** Marks, S. (Lawrence Berkeley Lab., CA (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Light Source (ALS) storage ring sextupole is a unique multi-purpose magnet. It is designed to operate in the primary or sextupole mode and in three auxiliary trim modes: horizontal steering, vertical steering, and skew quadrupole. Klaus

Halbach developed a perturbation theory for iron-dominated magnets which provides the basis for this design. Many magnet designers, certainly those who have been exposed to Klaus, are familiar with this theory and have used it for such things as evaluating the effect of assembly alignment errors. The ALS sextupole design process was somewhat novel in its use of the perturbation theory to design essential features of the magnet. In particular, the steering and skew quadrupole functions are produced by violating sextupole symmetry and are thus perturbations of the normal sextupole excitation. The magnet was designed such that all four modes are decoupled and can be excited independently. This paper discusses the use of Halbach's perturbation theory to design the trim functions and to evaluate the primary asymmetry in the sextupole mode, namely, a gap in the return yoke to accommodate the vacuum chamber. Prototype testing verified all operating modes of the magnet and confirmed the expected performance from calculations based upon the Halbach perturbation theory. A total of 48 sextupole magnets of this design are now installed and operating successfully in the ALS storage ring.

24250 (LS–160) **APS storage ring vacuum chamber tests for dimensional stability after bakeout cycling while under vacuum.** Wehrle, R.; Nielsen, R. Argonne National Lab., IL (United States). Sep 1990. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015500. Source: OSTI; NTIS; GPO Dep.

Vacuum chamber sections No. 1 and No. 2 were used for these tests. Section No. 1, a short straight section, is representative in these tests of Sections No. 3 and No. 5 as well. Section No. 2 is the longer curved section used within the dipole bend magnets and is representative of the similar Section No. 4. The combination of Sections No. 1 and No. 2 joined by a connected bellows was mounted as presently planned for the final installation. This afforded an early testing of chamber positional stability after bakeout cycling. Tests of chamber dimensional stability were also made during vacuum cycling.

24251 (LS–166) **A radial coil probe for quadrupole magnet measurements.** Kim, S.H. Argonne National Lab., IL (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015217. Source: OSTI; NTIS; INIS; GPO Dep.

This note describes a rotating coil probe of "radial-winding geometry" for the measurements of the magnetic center, quadrupole fields and multipole coefficients of quadrupole magnets. The active length of the coil is longer than the magnet length, so that all the measurements will be integrated values along the longitudinal direction of the magnets. Errors of the measurements due to the fabrication tolerances of the coil are discussed.

24252 (LS–167) **Tagential winding coil probes for dipole, quadrupole and sextupole magnet measurements.** Kim, S.H. Argonne National Lab., IL (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015231. Source: OSTI; NTIS; INIS; GPO Dep.

The number of coils for a rotating coil probe of "tangential winding geometry depends on the requirements of the magnet measurements. In order to measure the main field, multipole coefficients and the location of the magnetic center axis, two sets of coils are sufficient for a rotating coil probe of "radial winding geometry." A probe of tangential winding geometry, on the other hand, requires more than two sets of coils to measure the above field parameters. This note describes probes of tangential winding geometry with a minimum number of coils for dipole, quadrupole and sextupole magnet measurements.

24253 (LS–168) **Design of kicker magnet and power supply unit for synchrotron beam injection.** Wang, Ju. Argonne National Lab., IL (United States). Mar 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015230. Source: OSTI; NTIS; INIS; GPO Dep.

To inject beams from the positron accumulator ring (PAR) into the synchrotron, a pulsed kicker magnet is used. The specifications of this kicker magnet and the power supply unit are listed and discussed in this report.

24254 (LS–171) **Magnet measurement interfacing to the G-64 Euro standard bus and testing G-64 modules.** Hogrefe, R.L. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015227. Source: OSTI; NTIS; INIS; GPO Dep.

The Magnet Measurement system utilizes various modules with a G-64 Euro (Gespac) Standard Interface. All modules are designed to be software controlled, normally under the constraints of the OS-9 operating system with all data transfers to a host computer accomplished by a serial link.

24255 (LS–172) **Cleaning of aluminum after machining with coolants.** Roop, B. Argonne National Lab., IL (United States). [1995]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015226. Source: OSTI; NTIS; INIS; GPO Dep.

An x-ray photoemission spectroscopic study was undertaken to compare the cleaning of the Advanced Photon Source (APS) aluminum extrusion storage ring vacuum chambers after machining with and without water soluble coolants. While there was significant contamination left by the coolants, the cleaning process was capable of removing the residue. The variation of the surface and near surface composition of samples machined either dry or with coolants was negligible after cleaning. The use of such coolants in the machining process is therefore recommended.

24256 (LS–173(ANL)) **Radial and tangential winding coil probes for sextupole magnet measurements.** Kim, S.H. Argonne National Lab., IL (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015545. Source: OSTI; NTIS; INIS; GPO Dep.

Rotating coil probes of radial and tangential winding geometries for the measurements of the magnetic center, main field integral and multipole coefficients of sextupole magnets are describes. Two sets of coils are sufficient for a probe of radial winding geometry. For a tangential winding probe, however, typically several sets of coils are required to measure the above magnetic parameters. The tangential coil geometry in this note is described with three sets of coils. The main sextupole field coefficients are defined as b_2 = $1.0cm^{-2}$ and $a_2 = 0$ for the expression of the multipole field coefficients.

24257 (LS–181) **Power supplies for the injector synchrotron quadrupoles and sextupoles.** Fathizadeh, M. Argonne National Lab., IL (United States). [1995]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015207. Source: OSTI; NTIS; INIS; GPO Dep.

This light source note will describe the power supplies for the injector synchrotron quadrupole and sextupole magnets. The injector synchrotron has two families of quadrupole magnets. Each family consists of 40 quadrupole magnets connected in series. These magnets are energized by two phase-controlled, 12-pulse power supplies. Therefore, each power supply will be rated to deliver the necessary power to only 40 quadrupole magnets. The two families of sextupole magnets in the injector synchrotron each consists of 32 sextupole magnets connected in series, powered by a phase-controlled power supply. Thus, each power supply shall be capable of delivering power to only 32 sextupole magnets.

24258 (LS–185) **Power supply control units for APS ring magnets.** Despe, O.D. Argonne National Lab., IL (United States). 15 Apr 1990. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015399. Source: OSTI; NTIS; INIS; GPO Dep.

The APS storage ring (1104 meters) is divided into 40 sectors. Each sector has 38 magnet coils in five magnet bases. Every alternate sector has an additional quadrupole magnet for skew correction. AR the main dipole magnets, two in each sector are connected in series and fed from one power supply unit. A base is controlled by one power supply control unit (PSCU). Each PSCU is connected to the host computer via a local area network (LAN). This note discusses the hardware configuration of the typical power supply control system used by the APS magnets and the software commands supported by the PSCU.

24259 (LS–186) **Cavity design and beam simulations for the APS rf gun.** Borland, M. Argonne National Lab., IL (United States). 15 Nov 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015400. Source: OSTI; NTIS; INIS; GPO Dep.

An earlier note discussed the preliminary design of the 1-1/2 cell RF cavity for the APS RF gun. This note describes the final design, including cavity properties and simulation results from the program rf gun. The basic idea for the new design was that the successful SSRL design could be improved upon by reducing fields that had nonlinear dependence on radius. As discussed previously, this would reduce the emittance and produce tighter momentum and time distributions. In addition, it was desirable to increase the fields in the first half-cell relative to the fields in the second half-cell, in order to allow more rapid initial acceleration, which would reduce the effects of space charge. Both of these goals were accomplished in the new design.

24260 (LS–190) **Development of General Purpose Data Acquisition Shell (GPDAS).** Chung, Y.; Kim, K. Argonne National Lab., IL (United States). [1995]. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015223. Source: OSTI; NTIS; INIS; GPO Dep.

This note is intended as an abbreviated introduction to the concept and the structure of General Purpose Data Acquisitions Shell (GPDAS) and assumes the reader has a certain level of familiarity with programming in general. The structure of the following sections consists of brief explanations of the concepts and commands of GPDAS, followed by several examples. Some of these are tabulated in the appendices at the end of this note.

24261 (LS–193) **BPM button characterization for offset calibration.** Chung, Y. Argonne National Lab., IL (United States). Mar 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015222. Source: OSTI; NTIS; INIS; GPO Dep.

In this note, a basic theory of wave propagation in dielectric media is discussed in conjunction with S parameters to derive the button gain coefficient g_e and an analytic expression for the signal from time domain reflectometry (TDR) measurement on a cable and a button. The results can be used to measure the button capacitance and the characteristic impedances of the cable and the button feedthrough. Since g_e is a function of S parameters and the button capacitance C_p, a suggestion is made to make the gain coefficients the same for all four buttons in a BPM by carefully matching the buttons and the cables.

24262 (LS–197) **Preliminary cleaning tests on candidate materials for APS beamline and front end UHV components.** Nielsen, R.; Kuzay, T.M. Argonne National Lab., IL (United States). 12 May 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015221. Source: OSTI; NTIS; INIS; GPO Dep.

Comparative cleaning tests have been done on four candidate materials for use in APS beamline and front-end vacuum components. These materials are 304 SS, 304L SS, OFHC copper, and Glidcop® (Cu-Al_2O_3)- Samples of each material were prepared and cleaned using two different methods. After cleaning, the sample surfaces were analyzed using ESCA (Electron Spectography for Chemical Analysis). Uncleaned samples were used as a reference. The cleaning methods and surface analysis results are further discussed.

24263 (LS–200) **Effect of eddy current in the laminations on the magnet field.** Chung, Y.; Galayda, J. Argonne National Lab., IL (United States). Apr 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95015564. Source: OSTI; NTIS; INIS; GPO Dep.

In this note theory and measurements of the effect of the eddy current in the laminations on the magnet field are presented. The theory assumes a simple solenoid-type magnet with laminated iron core and ignores the end field effect. The measurements were made on the input voltage and current, and the dipole component of the magnetic field in the middle of the magnet bore. The amplitude and phase relations between these quantities give the field attenuation factor, phase delay, and resistance and inductance of the magnet as functions of frequency. Comparisons of results with theory are discussed.

24264 (LS–203) **Fundamental mode frequency of the storage ring single cell cavity.** Kang, Y.W. Argonne National Lab., IL (United States). 27 May 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015206. Source: OSTI; NTIS; INIS; GPO Dep.

The fundamental mode frequency of the prototype storage ring cavity has been measured with various port terminations and cavity temperatures. Since the highest tuned frequency of the prototype cavity with a tuner under the high RF power test condition is measured to be lower than the system specified frequency, a slight dimensional change in the cavity design is required for manufacturing future cavities. In addition to this, an extra dimensional correction is required to compensate the volume changes due to the tuner position and increased port sizes. In the following, the measured frequencies and the estimated frequency shift due to the volume changes are discussed. The correction to the internal dimension of the new cavity design based on the estimated frequency shift is also discussed.

24265 (LS–204) **Thermo-mechanical optimization of Fixed Mask 2 for APS front ends.** Nian, H.L.T.; Kuzay, T.M.; Sheng, I.C.A. Argonne National Lab., IL (United States). 27 Jul 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015205. Source: OSTI; NTIS; INIS; GPO Dep.

Fixed mask 2 (FM2) is one of the critical elements on the front end of the beamlines at the Advanced Photon Source (APS) now under construction at Argonne National Laboratory (ANL). The FM2 uses an enhanced heat transfer tube developed at ANL. Due to large thermal loads on these components, inclined geometry is used in the design to spread the footprint of the x-ray beam. Even then, thermal loads are very critical. To address the thermal and thermo-mechanical issues, analytical studies have been applied to a simplified model of the FM2 tube. The maximum temperature and maximum effective stress have been parametrically studied. Results for maximum temperatures and stresses are obtained and compared with the available strength/fatigue data for the materials proposed for the fixed mask design.

24266 (LS–205) **Thermo-mechanical optimization of photon shutter 1 for APS front ends.** Nian, H.L.T.; Kuzay, T.M.; Sheng, I.C.A. Argonne National Lab., IL (United States). 28 Jul 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015390. Source: OSTI; NTIS; INIS; GPO Dep.

Photon shutter 1 (PS1) is one of the most critical elements on the front end of the beamlines at the Advanced Photon Source (APS) now under construction at Argonne National Laboratory (ANL). The PS1 uses an enhanced heat transfer tube developed at ANL. Due to large thermal loads on these components, inclined geometry is used in the design to spread the footprint of the x-ray beam. Even then, thermal loads are very critical. To address the thermal and thermo-mechanical issues, analytical studies have been applied to a simplified model of the shutter tube. The maximum temperature and maximum effective stress have been parametrically studied. Results for maximum temperatures and stresses are obtained and compared with the available strength/fatigue data for the materials proposed for the shutter design.

24267 (LS–207) **Interpolation of Hall probe calibration data.** Carnegie, D.W. Argonne National Lab., IL (United States). 23 Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015389. Source: OSTI; NTIS; INIS; GPO Dep.

Calibrated Hall-effect magnetic-field sensors will be used to map the magnetic field in insertion devices. Typical calibration data give the magnetic field as a function of measured signal and temperature on a two-dimensional grid. We need to calculate the magnetic field from the two measured signals. As an example, this work uses the calibration data supplied with a Hall-effect measurement system from Group 3 Technology Ltd. Detailed field-versus-signal data are given for three calibration temperatures for each of four

gain settings. Two methods for performing the interpolation are presented for a fixed gain setting. The first method fits the three field-versus-signal data sets to three polynomials minimizing the sum of squares of the errors and then interpolates for the temperature. The second method uses a bivariate interpolation routine. In this method, there are no residual errors at the calibration points. The two methods are compared. The selection of the method used will depend on what errors are present in the calibration data.

24268 (LS–208) **Thermo-mechanical parametric studies of Fixed Mask 1 and Photon Shutter 2 for APS front ends.** Nian, H.L.T.; Kuzay, T.M.; Sheng, I.C.A. Argonne National Lab., IL (United States). 3 Sep 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015388. Source: OSTI; NTIS; INIS; GPO Dep.

Fixed Mask 1 (FM1) and Photon Shutter 2 (PS2) are two of the critical elements on the front end of the beamlines at the Advanced Photon Source (APS) now under construction at Argonne National Laboratory (ANL). FMI and PS2 use an enhanced heat transfer tube developed at ANL. Due to a high localized thermal gradient on these components, inclined geometry is used in their design to spread the footprint of the x-ray beam. Complete closed form solutions for steady state conditions have been developed for the analyses of the thermal and thermo-mechanical behavior of FMI and PS2. A modified Manson-Coffin fatigue relation is proposed to predict the predict the thermal fatigue. The maximum temperatures and maximum effective stresses have been parametrically studied. Fatigue-failure life predictions are presented for the FM1 and PS2 designs.

24269 (LS–209) **Effect of vacuum chamber eddy current and compensation by digital feedback.** Chung, Y. Argonne National Lab., IL (United States). 27 Jul 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015387. Source: OSTI; NTIS; INIS; GPO Dep.

Measurement of the effect of the eddy current induced in the APS storage ring vacuum chamber by the storage ring sextupole magnet and its compensation using digital feedback with proportional, integral, and derivative (PID) control algorithm are presented. The magnetic field in the vacuum chamber shows strong quadrupole and sextupole components varying with frequency, in addition to significant attenuation and phase shift. Large changes in the magnet resistance and inductance were also observed. Development of a theory of digital feedback to obtain system responses and the conditions for optimal control will be described, in conduction with design of a digital filter to compensate for the eddy current effect.

24270 (LS–215) **Diamond monochromator for high heat flux synchrotron x-ray beams.** Khounsary, A.M.; Smither, R.K.; Davey, S.; Purohit, A. Argonne National Lab., IL (United States). 28 Jan 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015392. Source: OSTI; NTIS; INIS; GPO Dep.

Single crystal silicon has been the material of choice for x-ray monochromators for the past several decades. However, the need for suitable monochromators to handle the high heat load of the next generation synchrotron x-ray beams on the one hand and the rapid and on-going advances in synthetic diamond technology on the other make a compelling case for the consideration of a diamond monochromator system. In this paper, we consider various aspects, advantages and disadvantages, and promises and pitfalls of such a system and evaluate the comparative performance of a diamond monochromator subjected to the high heat load of the most powerful x-ray beam that will become available in the next few years. The results of experiments performed to evaluate the diffraction properties of a currently available synthetic single crystal diamond are also presented. Fabrication of a diamond-based monochromator is within present technical means.

24271 (LS–216) **Feasibility of using a high power CO_2 laser as an alternative source to test high heat load x-ray optics.** Fernandez, P.B. Argonne National Lab., IL (United States). 10 May 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015391. Source: OSTI; NTIS; INIS; GPO Dep.

To determine the feasibility of using the CO_2 laser at LAL as an alternative heat source for x-ray optics tests, we have studied the absorption of the 10.6-micron laser light in silicon for two different dopant concentrations, using the resistivity as a predictor for the absorption length. We describe the results from these tests in this report.

24272 (LS–225) **RF characteristics of the APS storage ring isolation valve.** Song, J.J. Argonne National Lab., IL (United States). 31 Mar 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015233. Source: OSTI; NTIS; INIS; GPO Dep.

The RF impedance of the sector isolation valve of the APS storage ring system was measured by the wire method with a synthetic pulse technique. The coupling impedance as well as the energy loss of the isolation valve with and without an RF liner or screen, and the flange gap of the various sizes was calculated from the measurements. There appear to be resonances at certain frequencies in the absence of an RF liner that might cause an unacceptably large coupling impedance. Data with various sizes of the flange gap show that a good RF contact around any flange is necessary. The results also are compared with computer simulation from MAFIA. The measured impedance due to the RF liner alone is within 0.2% of the total APS impedance budget.

24273 (LS–232) **Tests on conducted electrical noise on a storage ring dc-dc converter cabinet.** Carwardine, J.J. Argonne National Lab., IL (United States). 22 Feb 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015234. Source: OSTI; NTIS; INIS; GPO Dep.

Electrical noise is produced by switching transients in the power supply converters which excite resonances formed by stray capacitance and cable inductance. This noise is present not only on the load cables, but also on ground cables of the magnet and of the converter cabinet. Since there will eventually be a large number of cabinets running at one time, tests were carried out to characterize the noise and to investigate possible techniques for reducing the levels. The tests were carried out on the test girder and converter cabinet set up in 412 area. There were four magnets installed on the girder – two 0.5m quadrupoles, a 0.8m quadrupole, and a sextupole. These tests were carried out on one of the 0.5m quadrupoles. It should be noted that with this setup, the raw dc power was supplied at around 70V. In the final configuration, a 0.5m quad will be fed from a 40V raw supply. Consequently, the switching transients observed during the tests are likely to be higher than will occur in reality. Noise currents contain two main components: a low frequency component at around 50kHz, and a higher frequency component at around IMHz. It is the latter component which is of primary concern. Currents measured on the dc load cables typically were around one ampere, while currents into the building ground system were only a few tens of milliamps. Several methods were used to try reducing the noise currents, but only the addition of a series impedance was successful – other methods either had no effect or increased the ground currents.

24274 (LS–233) **Electromagnetic field analysis of septum magnet for APS positron accumulator ring.** Yokoi, Toshiaki; Turner, L.R. Argonne National Lab., IL (United States). [1995]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015232. Source: OSTI; NTIS; INIS; GPO Dep.

This report consists of three parts. The first part describes a numerical analysis method for the electromagnetic field analysis of a septum magnet. A novel improvement to the treatment of exciting currents in the time-domain is proposed. The second part discusses numerical predictions of the electromagnetic characteristics of the APS PAR septum. The time variations of stray field and eddy currents are shown for three magnet designs. The last part explores how decreasing the septum material conductivity affects the stray field. The decrease of conductivity may be caused by an inadequate manufacturing of the septum material. The significance of a high quality septum, or flat interface between copper and iron, is emphasized from a point of view of stray field. An ideal method for joining two different metals without distortion, called HIP (Hot

Isostatic Pressing), is introduced and recommended based on the authors' experience.

24275 (LS–235) **SRI CAT Section 1 bending magnet beamline description.** Srajer, G.; Rodricks, B.; Assoufid, L.; Mills, D.M. Argonne National Lab., IL (United States). 10 Mar 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015213. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses: APS bending magnet source; beamline layout; beamline optical components; beamline operation; time-resolved studies station; polarization studies station; and commissioning and operational schedule.

24276 (LS–238) **High-heat-load studies of silicon and diamond monochromators using the APS/CHESS prototype undulator.** Mills, D.M.; Lee, W.K.; Smither, R.K.; Fernandez, P.B. Argonne National Lab., IL (United States). 16 Sep 1994. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015212. Source: OSTI; NTIS; INIS; GPO Dep.

The results of the latest high-heat-load studies made on the APS/CHESS prototype undulator are summarized. Four different crystals were tested: two slotted, symmetrically cut silicon crystals and a core-drilled, asymmetrically cut silicon crystal and a diamond crystal that was jet cooled using water. The purpose of the silicon crystal tests was to reevaluate the surface power loading at which appreciable degradation of the diffraction efficiency was observed. The diamond tests, allotted only a brief period of time during the testing period, were our first attempt at using diamonds for high-heat-flux x-ray monochromators and were performed primarily to gain first-hand experience with diamond monochromators. Measurements with the silicon crystal at 5 keV reconfirmed our previous measurements of performance degradation at around 4-6 watts/mm^2 using liquid gallium with slotted coolant channels. A value of only 2 watts/mm^2 was observed to cause a degradation of the diffraction performance at 15 keV with the same crystals due to the increased sensitivity to strain because of the reduced Darwin widths. The performance of the asymmetric crystal, with its core-drilled coolant channels, was not found to be as good as that of the slotted crystals. This was probably due to poorer heat transfer properties of the core-drilled geometry in combination with the narrowing of the rocking curves because of the asymmetric cut. Fabrication issues for construction of the gallium-cooled crystals is also discussed. Although the diamonds were only successfully tested at low total power the results were very encouraging and motivated us to accelerate our program on the use of diamonds for high-heat-load monochromators.

24277 (LS–239) **The effect of incident angle on the shielding thickness for secondary bremsstrahlung.** Haeffner, D.R.; Job, P.K. Argonne National Lab., IL (United States). 8 Dec 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015214. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, the results of simulations will be given for secondary bremsstrahlung beams that are incident upon various thicknesses of Pb at several angles.

24278 (LS–240) **Identification of root cause of vibration of a liquid-gallium-cooled silicon monochromator and recommendations for abatement.** Chen, S.S.; Zhu, S.; Wambsganss, M.W.; Jendrzejczyk, J.A.; Lee, W.K. Argonne National Lab., IL (United States). Aug 1994. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015215. Source: OSTI; NTIS; INIS; GPO Dep.

Perfect single crystals of silicon are used to monochromate the high-intensity X-ray beams in the Advanced Photon Source at Argonne National Laboratory. Depending on the crystal geometry and the insertion device, the crystal may absorb anywhere from several hundred watts to in excess of a thousand watts. To minimize the thermal distortions in the crystal, this heat must be efficiently removed. Several approaches to this problem are being developed at the APSP including the use of inclined-crystal geometries, cryogenic cooling, liquid-gallium cooling, thin crystals, and the use of diamond. Most of these approaches require coolant flow within the crystals themselves. One issue of concern is the flow-induced vibrations. Two series of tests were performed earlier for a near-prototypical gallium-cooled crystal. This LS note describes a series of tests to measure the general vibration response characteristics of a complete liquid-gallium-cooled inclined-crystal monochromator system.

24279 (LS–243) **Dose rate estimates in the first optical enclosure due to particle beam loss in the insertion device transition region during injection.** Job, P.K.; Moe, H.J. Argonne National Lab., IL (United States). 9 May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015822. Source: OSTI; NTIS; INIS; GPO Dep.

The particle beam, during injection into the storage ring, can be partly lost in one of the transition regions between the storage-ring vacuum chamber and the insertion-device (ID) straight section. The transition region is a copper interface between a standard aluminum vacuum chamber and an insertion-device vacuum chamber. This can be a problem, at least in the first few insertion devices where the injected beam is still unstable. It may create higher photon and neutron dose rates in the first optical enclosures of the upstream ID beamlines adjacent to this region. This report presents the results of the dose rate estimates for such an event and some recommendations for mitigation.

24280 (SLAC-PUB–95-6879) **Operation and performance of the PEP-II prototype longitudinal damping system at ALS.** Teytelman, D. (and others); Claus, R.; Fox, J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–134: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013281. Source: OSTI; NTIS; INIS; GPO Dep.

A modular programmable longitudinal feedback system has been developed as a component of the PEP-II R+D program. This system is based on a family of VME and VXI packaged signal processing functions which implement a general purpose digital feedback controller for accelerators with bunch spacings of 2 ns. A complete PEP-II prototype system has been configured and installed for use at the LBL Advanced Light Source. The system configuration used for tests at the ALS is described and results are presented showing the action of the feedback system. Open and closed loop results showing the detection and calculation of feedback signals from bunch motion are presented and the system is shown to damp coupled-bunch instabilities in the ALS. Use of the system for accelerator diagnostics is illustrated via measurement of grow-damp transients which quantify growth rates without feedback, damping rates with feedback, and identify unstable modes.

24281 (SLAC-PUB–95-6894) **High-intensity single bunch instability behavior in the new SLC damping ring vacuum chamber.** Bane, K. (and others); Bowers, J.; Chao, A. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–252: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013397. Source: OSTI; NTIS; INIS; GPO Dep.

New low-impedance vacuum chambers were installed in the SLC damping rings for the 1994 run after finding a single bunch instability with the old chamber. Although the threshold is lower with the new vacuum chamber, the instability is less severe, and we are now routinely operating at intensities of 4.5 x 10^{10} particles per bunch (ppb) compared to 3 x 10^{10} ppb in 1993. The vacuum chamber upgrade is described, and measurements of the bunch length, energy spread, and frequency and time domain signatures of the instability are presented.

24282 (SLAC-PUB–95-6906) **Loaded delay lines for future RF pulse compression systems.** Jones, R.M. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Wilson, P.B.; Kroll, N.M. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ;

FG03-93ER40759. (CONF-950512–132: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013283. Source: OSTI; NTIS; INIS; GPO Dep.

The peak power delivered by the klystrons in the NLCRA (Next Linear Collider Test Accelerator) now under construction at SLAC is enhanced by a factor of four in a SLED-II type of R.F. pulse compression system (pulse width compression ratio of six). To achieve the desired output pulse duration of 250 ns, a delay line constructed from a 36 m length of circular waveguide is used. Future colliders, however, will require even higher peak power and larger compression factors, which favors a more efficient binary pulse compression approach. Binary pulse compression, however, requires a line whose delay time is approximately proportional to the compression factor. To reduce the length of these lines to manageable proportions, periodically loaded delay lines are being analyzed using a generalized scattering matrix approach. One issue under study is the possibility of propagating two TE_o modes, one with a high group velocity and one with a group velocity of the order 0.05c, for use in a single-line binary pulse compression system. Particular attention is paid to time domain pulse degradation and to Ohmic losses.

24283 (SLAC-PUB–95-6907) **Investigation of the beam impedance of a slowly varying waveguide.** Jones, R.M.; Heifets, S.A. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–131: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013284. Source: OSTI; NTIS; INIS; GPO Dep.

A perturbation method is used to obtain analytic expressions for the multipole longitudinal and universe beam impedance for an arbitrary waveguide whose radius is slowly varying and for the specific case of a symmetric small-angle taper. This method is also applicable for a particle in a wiggler undergoing periodic motion.

24284 (SLAC-PUB–95-6908) **Nanometer resolution BPM using damped slot resonator.** Hartman, S.C. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Shintake, T.; Akasaka, N. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–130: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013285. Source: OSTI; NTIS; INIS; GPO Dep.

A new type of high resolution beam position monitor called the damped slot resonator rf BPM has been installed at the focal point of the FFTB. It is comprised of a cylindrical resonant cavity with a tuned choke joint at the TM_{110} resonances. The BPM has a large dynamic range from the nm to mm range with a minimum resolution of 1 nm. We report on the rf cavity cold tests performance, processing electronics design, and some experimental results obtained in obtained in the high energy electron beam line.

24285 (SSC–100-Rev.A) **Superconducting Super Collider Magnet System requirements. Revision A.** Superconducting Super Collider Lab., Dallas, TX (United States). 23 Oct 1986. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011223. Source: OSTI; NTIS; GPO Dep.

This report discusses the Superconducting Super Collider magnet system requirements when the following categories: Functions; operational performance requirements; system configuration and essential features; structural requirements; availability/reliability; instrumentation and control requirements; design life; environment; maintenance requirements; interface systems; quality assurance; safety; and applicable codes and standards.

24286 (SSCL–671) **Impedance measurements of rf joint (Bellows shield) for collider.** Walling, L.; Spayd, N. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011189. Source: OSTI; NTIS; INIS; GPO Dep.

The collider ring for the Superconducting Super Collider (SSC) requires 6000 bellows to connect magnets and allow movement due to contraction of the magnets during cooling. Bellows have unacceptably high impedances in the collider ring and must be shielded. The original impedance budget (which was based on an older design) for 6000 rf joints was estimated at Z/n = 0.12 ohm for the longitudinal and Zt = 10 Mohn/m for the transverse impedance. With the new design it was hoped to lower these numbers to Z/n = 0 .075 ohm and Zt = 2.8 Mohm/m.

24287 (SSCL-Preprint–212) **Thermal and flow considerations for the 80 K shield of the SSC magnet cryostats.** Abramovich, S. (Superconducting Super Collider Lab., Dallas, TX (United States)); Yuecel, A.; Demko, J.; Thirumaleshwar, M. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–118: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011193. Source: OSTI; NTIS; INIS; GPO Dep.

The nominal temperatures in the SSC cryostat range between 4.2 K in the superconducting magnet and 300 K on the cryostat outer wall. To minimize the 4 K heat load, a thermal shield cooled by liquid and vapor nitrogen flows at 84 K and one a 20 K cooled by helium flow are incorporated in the cryostat. Tubes attached to the shields serve as conduits for cryogens. The liquid nitrogen tube in the cryostat is used for cryostat refrigeration and also for liquid distribution around the SSC rings. The second nitrogen line is used to return the vapor to the helium refrigerators for further processing. The nominal GN2 flow from a 4.3-km long cryogenic string (4 sections) to the surface is 64 g/s. The total liquid nitrogen consumption of approximately 5000 g/s will be supplied at one, two or more locations on the surface. The total heat load of the 80 K shield is estimated as 3.2 W/m. About 50% is composed of infrared radiation and remaining 50% by heat conduction through supports, vacuum barriers and other thermal connections between the shield and the 300 K outer wall. The required LN2 flow rate depends on the distribution and circulation schemes. The LN2 temperature will in turn vary depending on the flow rate and on the recooling methods used. For example, with a massflow of 400 g/s of LN2 the temperature rises from 82 K to 86 K between two compact recoolers 1 km apart. This temperature is higher thin desired. The temperature can be reduced by increasing the flow rate of the liquid or by using the continuous recooling. This paper discusses some thermal problems caused by certain mechanical designs of the 80 K shielding the possible improvement by using continuous recooling. In the following, we present results of the 80 K shield temperature distribution analysis, the 20 K shield heat load augmentation resulting from the increased 80 K shield temperatures, the continuous nitrogen recooling scheme and some flow timing related analysis.

24288 (SSCL-Preprint–221) **Low power RF beam control electronics for the LEB.** Mestha, L.K.; Mangino, J.; Brouk, V.; Uher, T.; Webber, R.C. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–119: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011194. Source: OSTI; NTIS; INIS; GPO Dep.

Beam Control Electronics for the Low Energy Booster (LEB) should provide a fine reference phase and frequency for the High Power RF System. Corrections applied on the frequency of the rf signal will reduce dipole synchrotron oscillations due to power supply regulation errors, errors in frequency source or errors in the cavity voltage. It will allow programmed beam radial position control throughout the LEB acceleration cycle. Furthermore the rf signal provides necessary connections during, adiabatic capture of the beam as injected into the LEB by the Linac and will guarantee LEB rf phase synchronism with the Medium Energy Booster (MEB) rf at a programmed time in the LEB cycle between a unique LEB bucket and a unique MEB bucket. We show in this paper a design and possible interfaces with other subsystems of the LEB such as the beam instrumentation, High Power RF Stations, global accelerator controls and the precision timing system. The outline of various components of the beam control system is also presented followed by some test results.

24289 (SSCL-Preprint–270) **Corrector magnets: Combined structural analysis of collider 50 mm aperture ordered wound sextupoles intedrior section.** Tran, V. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–122: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE95011196. Source: OSTI; NTIS; INIS; GPO Dep.

The 50mm aperture prototype collider ordered wound sextupole corrector magnets have been modeled with finite element techniques considering the individual and combined load cases of the preloading from keys, cooldown to 4 K and the effect of magnetic forces during energizing. Results of the analysis are presented as longitudinal, transverse and shear stresses for the ordered wound coils and as maximum von Mises stress for the carbon steel outer laminations, the stainless steel linear lamination, the carbon steel floating pole tips and the carbon steel keys.

24290 (SSCL-Preprint–430) **A high reliability oxygen deficiency monitoring system.** Parry, R.; Claborn, G.; Haas, A.; Landis, R.; Page, W.; Smith, J. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930511–525: PAC '93: international particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE95011198. Source: OSTI; NTIS; INIS; GPO Dep.

The escalating use of cryogens at national laboratories in general and accelerators in particular, along with the increased emphasis placed on personnel safety, mandates the development and installation of oxygen monitoring systems to insure personnel safety in the event of a cryogenic leak. Numerous vendors offer oxygen deficiency monitoring systems but fail to provide important features and/or flexibility. This paper describes a unique oxygen monitoring system developed for the Magnet Test Laboratory (MTL) at the Superconducting Super Collider Laboratory (SSCL). Features include: high reliability, oxygen cell redundancy, sensor longevity, simple calibration, multiple trip points, offending sensor audio and visual indication, global alarms for building evacuation, local and remote analog readout, event and analog data logging, EMAIL event notification, phone line voice status system, and multi-drop communications network capability for reduced cable runs. Of particular importance is the distributed topology of the system which allows it to operate in a stand-alone configuration or to communicate with a host computer. This flexibility makes it ideal for small applications such as a small room containing a cryogenic dewar, as well as larger systems which monitor many offices and labs in several buildings.

24291 (SSCL-Preprint–462) **Eddy current and quench loads and stress of SSC collider 4-K liner and the bore tube during magnet quench.** Leung, K.K.; Shu, Q.S. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930703–47: International cryogenic materials conference (ICMC), Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE95011134. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the response of the eddy current and quench loads on a proposed Superconducting SuperCollider 4-K liner system. The liner within a bore tube is designed to remove the radiated power and the photodesorbed gas that impair the beam tube vacuum. The bimetallic liner tube is subjected to cooldown and eddy current loads. The square liner tube is a two-shell laminated Nitronic-40 steel is used for strength and a copper inner layer for low impedance to the image currents. Perforated holes are used to remove the photodesorbed gases for vacuum maintenance. The holes are located in a low-stress area of the liner. Rectangular holes in a four-pole symmetry pattern are required for beam dynamic stability. The liner is conductivity cooled by the round steel bore tube with a 2-mm wall. The copper layer must not be stressed over the yield strength limit because copper properties such as conductivity are known to change when the copper is stressed over yield strength. This analysis will address liner system response under thermal, eddy current, and vaporized liquid helium loads in a quenching dipole magnet.

24292 (SSCL-Preprint–540) **The SSCL framework software plans.** Frederiksen, S. Superconducting Super Collider Lab., Dallas, TX (United States). Dec 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011204. Source: OSTI; NTIS; INIS; GPO Dep.

In about ten years the Superconducting Super Collider Laboratory (SSCL) will be Producing 40 TeV proton-proton interactions. The size and scale of the effort demands new approaches to design and develop software used by the experimental collaborations. The Physics Research Division Computing Department (PRCD) of the SSCL is developing (in collaboration with the Solenoidal Detector Collaboration (SDC) and Gamma, Electron and Muon (GEM) collaborations a support system which will be used to build and run the collaboration software. It will be used for simulating the events needed for detector development and for the analysis of these complicated events. The plans status of this program will be discussed.

24293 (SSCL-Preprint–555) **Toward design of the Collider Beam Collimation System.** Drozhdin, A.; Mokhov, N.; Soundranayagam, R.; Tompkins, J. Superconducting Super Collider Lab., Dallas, TX (United States). Feb 1994. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011034. Source: OSTI; NTIS; INIS; GPO Dep.

A multi-component beam collimation system for the Superconducting Super Collider is described. System choice justification and design requirements are presented. System consists of targets, scrapers, and collimators with appropriate cooling and radiation shielding. Each component has an independent control for positioning and aligning with respect to the beam. Results of beam loss distribution, energy deposition calculations, and thermal analyses, as well as cost estimate, are presented.

24294 (SSCL-Preprint–556) **Accidental beam loss in superconducting accelerators: Simulations, consequences of accidents and protective measures.** Drozhdin, A.; Mokhov, N.; Parker, B. Superconducting Super Collider Lab., Dallas, TX (United States). Feb 1994. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011035. Source: OSTI; NTIS; INIS; GPO Dep.

The consequences of an accidental beam loss in superconducting accelerators and colliders of the next generation range from the mundane to rather dramatic, i.e., from superconducting magnet quench, to overheating of critical components, to a total destruction of some units via explosion. Specific measures are required to minimize and eliminate such events as much as practical. In this paper we study such accidents taking the Superconducting Supercollider complex as an example. Particle tracking, beam loss and energy deposition calculations were done using the realistic machine simulation with the Monte-Carlo codes MARS 12 and STRUCT. Protective measures for minimizing the damaging effects of prefire and misfire of injection and extraction kicker magnets are proposed here.

24295 (SSCL-SR–1211) **Workshop on data acquisition and trigger system simulations for high energy physics.** Superconducting Super Collider Lab., Dallas, TX (United States). [1992]. 578p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-9204304–: Workshop on data acquisition and trigger system simulations for high energy physics, Waxahachie, TX (United States), 23-25 Apr 1992). Order Number DE95011164. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: DAQSIM: A data acquisition system simulation tool; Front end and DCC Simulations for the SDC Straw Tube System; Simulation of Non-Blocking Data Acquisition Architectures; Simulation Studies of the SDC Data Collection Chip; Correlation Studies of the Data Collection Circuit & The Design of a Queue for this Circuit; Fast Data Compression & Transmission from a Silicon Strip Wafer; Simulation of SCI Protocols in Modsim; Visual Design with vVHDL; Stochastic Simulation of Asynchronous Buffers; SDC Trigger Simulations; Trigger Rates, DAQ & Online Processing at the SSC; Planned Enhancements to

MODSEM II & SIMOBJECT – an Overview – R.; DAGAR – A synthesis system; Proposed Silicon Compiler for Physics Applications; Timed – LOTOS in a PROLOG Environment: an Algebraic language for Simulation; Modeling and Simulation of an Event Builder for High Energy Physics Data Acquisition Systems; A Verilog Simulation for the CDF DAQ; Simulation to Design with Verilog; The DZero Data Acquisition System: Model and Measurements; DZero Trigger Level 1.5 Modeling; Strategies Optimizing Data Load in the DZero Triggers; Simulation of the DZero Level 2 Data Acquisition System; A Fast Method for Calculating DZero Level 1 Jet Trigger Properties and Physics Input to DAQ Studies.

24296 (SSC-SR–1004) **Superconducting Super Collider reference design magnets Style "D" cost design. Contents.** Yourd, R. Superconducting Super Collider Lab., Dallas, TX (United States). 1 Apr 1985. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011068. Source: OSTI; NTIS; GPO Dep.

This note describes a "Design D" style superconducting dipole magnet being studied for the SSC. This particular version of the design is being developed for initial manufacturing studies and reference cost estimate comparison. The main bending magnets are being considered in detail because they are the most costly elements of the machine and, therefore, require considerable R&D to verify performance and to develop the most economical design. Also to be described (but not in this note) are the quadrupole magnets, field correction magnets, and certain special magnets.

24297 (SSC-SR–1010) **Magnet Technical Review Panel. Final report.** Superconducting Super Collider Lab., Dallas, TX (United States). 25 Jul 1985. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011074. Source: OSTI; NTIS; GPO Dep.

This report discusses the following topics on the Superconducting Super Collider: Present status of magnet technology; description of various magnet systems; development of superconducting wire and cable; and R&D program.

24298 (SSC-SR–1025) **Magnet measurement workshop.** Lawrence Berkeley Lab., CA (United States). SSC Central Design Group. Dec 1986. 126p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-8611319–Summ.: Superconducting Super Collider magnet measurement workshop, Berkeley, CA (United States), 18-20 Nov 1986). Order Number DE95011087. Source: OSTI; NTIS; GPO Dep.

This report covers the deliberations of the participants the workshop and some subsequent contributions. Section III, the report of the rotating coil group, includes a summary table of the major measuring systems in use today, with separate sections on each. Section IV is the summary report of the group that addressed other measuring techniques. Because one of the limits of all the techniques being considered is electronic data acquisition, Section V addresses this topic. A set of issues relevant to magnetic field measurements of SSC dipoles was raised and addressed during the workshop. These are included as Section VI. Section VII includes a complete list of attendees with their addresses and a separate list of the members of the two working groups.

4304 Storage Rings

Refer also to citation(s) 24066, 24107, 24134, 24250, 24258, 24259, 24264, 24265, 24275, 24278, 24280

24299 (ANL/APS/CP–84921) **Cooling the APS storage ring radio-frequency accelerating cavities: Thermal/stress/fatigue analysis and cavity cooling configuration.** Primdahl, K.; Kustom, R. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950512–198: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013405. Source: OSTI; NTIS; INIS; GPO Dep.

The 7-GeV Advanced Photon Source positron storage ring requires sixteen separate 352-MHz radio-frequency (rf) accelerating cavities. Cavities are installed as groups of four, in straight sections used elsewhere for insertion devices. They occupy the first such straight section after injection, along with the last three just before injection. Cooling is provided by a subsystem of the sitewide deionized water system. Pumping equipment is located in a building directly adjacent to the accelerator enclosure. A prototype cavity was fabricated and tested where cooling was via twelve 19-mm-diameter [3/4 in] brazed-on tubes in a series-parallel flow configuration. Unfortunately, the thermal contact to some tubes was poor due to inadequate braze filler. Here, heat transfer studies, including finite-element analysis and test results, of the Advanced Photon Source (APS) storage ring 352-MHz rf accelerating cavities are described. Stress and fatigue life of the copper are discussed. Configuration of water cooling is presented.

24300 (BNL–61191) **The RHIC accelerating cavity prototype tuner.** Ratti, A.; Brennan, J.M.; Brodowski, J.; Onillon, E.; Rose, J. Brookhaven National Lab., Upton, NY (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–139: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011806. Source: OSTI; NTIS; INIS; GPO Dep.

The RHIC Accelerating System runs at 26.7 MHz and is required to have an operating range of 85 kHz during the acceleration cycle. Since it also must provide sufficient range to cover manufacturing errors and temperature variation, a requirement of 300 kHz has been specified. A mechanical approach acting on the cavity accelerating gap has been chosen for financial reasons over a ferrite approach. A prototype has been constructed and fully tested on the existing test cavity, using the tuning loop feedback circuitry developed for this task. Results from both the loop response and the power tests of the prototype indicate that this design will successfully meet the performance requirements for the RHIC Accelerating Cavity.

24301 (BNL–61848) **Orbit stability improvement at the NSLS x-ray ring.** Safranek, J.; Singh, O.; Solomon, L. Brookhaven National Lab., Upton, NY (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–166: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013234. Source: OSTI; NTIS; GPO Dep.

We describe recent improvements in both the short an long-term orbit stability at the NSLS X-Ray Ring. The short-term stability has been improved by increasing the gain and the bandwidth of the global harmonic feedback systems. The long-term horizontal orbit drift over the course of a fill has been reduced by including the rf-frequency in the orbit feedback. Work is in progress to further reduce orbit drift by compensating for thermally induced mechanical motions of the beam position monitors (BPMs).

24302 (BNL–61853) **Experimental determination of linear optics including quadrupole rotations.** Safranek, J. Brookhaven National Lab., Upton, NY (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950512–217: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013486. Source: OSTI; NTIS; INIS; GPO Dep.

The measured response matrix giving the change in orbit at beam position monitors (BPMs) with changes in steering magnet excitation can be used to accurately determine many important parameters in a storage ring. Using the NSLS X-Ray Ring measured response matrix we have determined the gradients in all 56 quadrupole magnets; the calibration of the steering magnets and BPMs; the rotational mis-alignments of the quadrupoles, steering magnets, and BPMs about the electron beam direction; the longitudinal magnetic centers of the orbit steering magnets; and the transverse mis-alignments of the sextupoles. Random orbit measurement error of the BPMs propagated to give 0.04% rms error in determination of individual quadrupole gradients and 0.4 mrad rms error in the determination of quadrupole rotational alignment. Small variations of a few parts in a thousand in the quadrupole gradients within an individual family were resolved. The improved understanding of the X-Ray Ring has enabled us to better control the electron beam size.

24303 (DOE/EA–0909) **Programmed improvements of the alternating gradient synchrotron complex at Brookhaven**

National Laboratory, Upton, New York. Environmental assessment. USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1994. 52p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012130. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose and need for DOE to undertake the actions described in this document are to improve the efficiency of the Alternating Gradient Synchrotron (AGS) complex. Benefits would include optimization of the AGS scientific program, increased high-energy and nuclear physics experimentation, improved health and safety conditions for workers and users, reduced impact on the environment and the general public, energy conservation, decreased generation of hazardous and radioactive wastes, and completion of actions required to permit the AGS to be the injector to the Relativistic Heavy Ion Collider (RHIC)., Improved efficiency is defined as increasing the AGS's capabilities to capture and accelerate the proton intensity transferred to the AGS from the AGS booster. Improved capture of beam intensity would reduce the beam losses which equate to lost scientific opportunity for study and increased potential for radiation doses to workers and the general public. The action would also refurbish magnets used in the transfer tunnel which connects the AGS complex to RHIC to permit smooth injection of beam into the RHIC accelerator. These magnets were previously used to direct beam to fixed targets for high energy physics studies but have hot received proper maintenance to be reliable as injectors to RHIC. The document describes alternative actions, the affected environment, and environmental impacts.

24304 (JINR-D–9-92-455, pp. 43-50) **Status and development of UNK.** Myznikov, K.P. (Institut Fiziki Vysokikh Ehnergij, Protvino (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Present status of construction and development of the Serpukhov Tevatron is described. The construction of the 2.7 km long injection channel arranged between the U-70 and the UNK-1 is completed. The construction activities for the preparation of the extraction channel arranged between the U-70 and the injection channel are accomplished. The UNK 20.7 km long tunnel driving is completed. The vacuum chamber of the 16 km long ring regular section is produced. The 50% of waveguides are manufactured. The UNK-1 equipment is being tested. The batch of superconducting dipoles and correctors is being produced. 14 refs., 1 tab., 6 figs.

24305 (JINR-D–9-92-455, pp. 53-57) **Routine beam diagnostics with application of electrostatic beam monitors at VEPP-4 M storage ring.** Kalinin, A.S. (RAN Sibirskoe Otdelenie, Inst Yadernoj Fiziki im. G.I.Budkera, Novosibirsk (Russian Federation)); Simonov, E.A.; Shatilov, D.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The VEPP-4 M beam monitoring system comprising 54 beam monitors is described. The scheme of the pick-up station is given. The beam monitoring system is constructed in the CAMAC standard. One of the storage ring computer is used for beam monitoring. The accident short-circuit magnet was identified by means of the given beam monitoring system during beam transport. 4 refs., 1 fig.

24306 (JINR-D–9-92-455, pp. 78-81) **Suppression of resistive instability of a bunched beam in the UNK first stage using a digital recursive filter in the feedback circuit.** Zhabitskij, V.M. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Korenev, I.L.; Yudin, L.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Technique and new fast system of proton bunch beam coherent betatron oscillations suppression in the UNK first stage are suggested. The system comprises two beam monitors and two pushers. Differential equations are reduced to linear difference matrix equation which is investigated for stability using unilateral Z-transformation. 10 refs.

24307 (JINR-D–9-92-455, pp. 82-86) **Influence of errors in displacement of beam monitors and pushers on parameters of a system for suppression of resistive instability in the UNK first stage.** Zhabitskij, V.M. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Chernov, P.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Influence of errors in the displacement of beam monitors (BM) and magnetic pushers (MP) in the system of betatron oscillations suppression at the UNK first stage is investigated. The system comprises two beam monitors and two pushers. The analysis showed that difference in betatron oscillation phase carry-over from $\pi/2$ radian at short intervals between BM and MP having similar sign worsens the conditions of coherent betatron oscillation suppression stronger than at different sign errors. 9 refs.

24308 (JINR-D–9-92-455, pp. 87-88) **Organization of a control system of beam transverse motion in the UNK first stage.** Ganbat, G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Glejbman, Eh.M.; Pilyar, N.V.; Rukoyatkina, T.V.; Koroleva, G.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

On-line system designed for controlling transversal beam motion in the UNK first stage is described. The system provides measurement of beam longitudinal part deflection from the center of vacuum chamber, operative data processing and generating correction signals. The system has the two-level structure. The lower level has three subsystems. Subsystems are based on the UNK CM 1810 programmable controllers and operate via the CM 1820 central computer. 3 refs.

24309 (JINR-D–9-92-455, pp. 89-92) **On the possibility of using the TMS 32010 and the TMS 32025 type signal processors in the feedback circuit for control of beam transverse motion in the UNK first stage.** Glejbman, Eh.M. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Problems of the application of the TMS 32010 and the TMS 32025 microprocessors in the UNK first stage beam feedback system are considered. These processors have a common bus of data reception (from analog-to-digital processor) and data transmission (to digital-to-analog processor) and are synchronized by a common clock generator. The number of used processors in a cascade depends on both algorithm (the number of command lines in a program) and on processor operating efficiency. 5 refs., 1 fig.

24310 (JINR-D–9-92-455, pp. 131-133) **Heavy Ion accelerating-storage complex (IYal, Kiev).** Val'kov, A.E. (Inst Yadernykh Issledovanij, Kiev (Ukraine)); Vishnevskij, I.N.; Dolinskij, A.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The description of the heavy-ion accelerating-storage complex (ASC) which is under development at the Kiev Institute for Nuclear Research is presented. ASC comprises the U-240 isochronous synchrotron as an injector into a fast booster and a synchrotron storage-ring. ASC will provide operation with nuclei and with ions in a wide range of masses (from protons to xenon) at the energy of up to 300 MeV/nucleon (A/Z = 2) at a high luminosity. The ASC scheme and parameters are presented. 1 tab., 2 figs.

24311 (JINR-D–9-92-455, pp. 265-268) **Results of calculation of thermoelastic deformations of UNK injection system 'URAL-60' linac accelerating structures.** Grushichev, I.A. (Institut Fiziki Vysokikh Ehnergij, Protvino (Russian Federation)); Popovkin, V.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Analysis of thermoelastic deformations due to thermal load of accelerating structure elements of the 'URAL-60' linear accelerator - the UNK injector is performed. Requirements for a cooling system of the accelerator operating in the pulse-train mode in the air temperature range of 15 - 20 deg C are formulated. 10 refs., 1 tab., 6 figs.

24312 (JINR-D–9-92-455, pp. 299-302) **Experimental study on high-voltage nanosecond generators of the 'Sibir'-2' storage ring injection system.** Kadnikov, A.A. (GosNII Fizicheskikh Problem im. F.V.Lukina, Moscow (Russian Federation)); Matveev, Yu.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the investigation of operating modes of pulse generators of the injection system of the 'Sibir'-2' storage ring the synchrotron radiation source are presented. Generators are constructed as coaxial type double-shaping lines with the control via the gas-filled three-electrode spark gaps. Test results revealed, that generators meet the requirements to output voltage of up to 60 kw, pulse rise time of about 3 ns and timing stability. 1 ref., 3 figs.

24313 (JINR-D–9-92-455, pp. 305-308) **Lenses magnetooptical stability to their geometry perturbations.** Bulyak, E.V. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)); Mytsykov, A.O. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The method of specifying tolerances of geometric sizes variation and the alignment of multiple lenses at storage rings is suggested and tested. The method is based on estimating multipole harmonics amplitudes mostly effecting beam dynamics at a storage ring. Amplitudes of the given harmonics are determined by the maximum likelihood method using the calculations. The computer code based on the suggested method is developed. Computer code test results are presented. 5 refs., 5 figs.

24314 (JINR-D–9-92-455, pp. 361-366) **Dipole and quadrupole magnets of the K4 ring of the K4 - K10 heavy ion storage complex.** Vakhromeev, Yu.M. (Nauchno-Issledovatel'skij Inst Ehlektrofizicheskoj Apparatury im. D.V.Efremova, Sankt-Peterburg (Russian Federation)); Edovin, I.V.; Kashikhin, V.S.; Myasnikov, Yu.A.; Popov, A.V.; Severgin, Yu.P.; Solames, A.A.; Stepin, E.P.; Shilkin, NJoint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The K4 facility is the fast storage ring with electron cooling designed for the acceleration and storage of practically all types of heavy ions. The U - 400M isochronous cyclotron is the injection of the storage ring. The ring electromagnetic system comprising dipole and quadrupole magnets creating 1.4 T field and 6.5 T/m gradient correspondingly is described. All magnets will be produced from blended cold-rolled electrolytic steel of 0.7 mm thick with surface insulation coating. Magnetic circuit sheets are stamped which allow one to obtain high accuracy of the production. 2 refs., 2 tabs., 2 figs.

24315 (JINR-D–9-92-455, pp. 369-374) **Present status at the VEPP - 4 M.** Anashin, V.V. (RAN Sibirskoe Otdelenie, Inst Yadernoj Fiziki im. G.I. Budkera, Novosibirsk (Russian Federation)); Anchugov, O.V.; Belomestnykh, S.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Present status of the VEPP - 4 upgrading is described. Non disturbing method of β-function measurement is worked out. The KEDR detector mounting is under way. The detector is designed for the solution of upsilon physics problems. The accelerator control system response is investigated. Orbit correction problems are being solved. 7 refs., 1 tab., 4 figs.

24316 (JINR-D–9-92-455, pp. 375-378) **Measurements of electron beam vertical vibrations and earth oscillations at the VEPP - 3 storage ring.** Lebedev, V.A. (RAN Sibirskoe Otdelenie, Inst Yadernoj Fiziki im. G.I. Budkera, Novosibirsk (Russian Federation)); Lebedev, P.K.; Parkhomchuk, V.V.; Chil'tsev, V.D. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of two-day measurements of electron beam oscillations and earth vertical vibrations at the VEPP - 3 are presented. Beam motion is shown to be connected and well correlated with accelerator magnetic elements vibrations at frequencies of lower than 40 - 50 Hz. At high frequencies, beam position fluctuations are determined mainly by instabilities of magnet and corrector supplying current. 4 refs., 5 figs.

24317 (JINR-D–9-92-455, pp. 379-382) **Study on seismic noise effect on electron beam parameters of the 'Zelenograd' specialized synchrotron radiation source.** Kuznetsov, S.I. (GosNII Fizicheskikh Problem im. F.V.Lukina, Moscow (Russian Federation)); Valentinov, A.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of measurements of quadrupole lens mechanical vibrations and electron beam displacement at the Zelenograd specialized synchrotron radiation source are presented. 4 refs., 3 figs.

24318 (JINR-D–9-92-455, pp. 383-392) **C-tau factory of the JINR accelerating-storage complex.** Aleksandrov, V.S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Antropov, V.K.; Arkhipov, O.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The description of the JINR accelerating-storage complex C-tau factory with the designed peak energy of 2.5 GeV is presented. The RF comprises four superconducting cavity resonators placed at the ends of long rectilinear gaps; the operation frequency is 4.76 MHz. Beam longitudinal size is 7 mm. Each arch comprises 12 cells of the FODO type periodicity. Wiggler magnets having 1.7 magnetic field and full length of 5.2 m designed for emittance

variation are placed at the regions of dispersion suppression. Parameters of the C-tau factory and some elements of the accelerating-storage complex are given. 5 refs., 2 tabs., 8 figs.

24319 (JINR-D–9-92-455, pp. 393-396) **Rearrangeable magnets structure of the C-tau factory with flat beam and monochromatization schemes.** Belovitskij, P.F. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The rearrangeable magnetic structure of the C-Tau factory is described and suggested. This magnetic structure provides the operation both with flat beam and electron-positron colliding beam energy monochromatization schemes. The rearrangement of magnetic structure is made at the expense of betatron oscillations phases overlapping in the FODO periodicity element and by means of wiggler magnets application. 7 refs., 1 tab., 2 figs.

24320 (JINR-D–9-92-455, pp. 397-400) **Storage-cooling ring for injection complex of F- and B-factories.** Anashin, V.I. (RAN Sibirskoe Otdelenie, Inst Yadernoj Fiziki im. G.I. Budkera, Novosibirsk (Russian Federation)); Belomestnykh, S.A.; Voroshilov, A.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The description of a magnetic structure of the cooling-storage ring of the F- and the B-factories is presented. The storage ring magnetic structure is a mirror-symmetrical about perpendicular axes crossing the centers of rectilinear gaps and comprises four quadrants. The storage ring admittances are chosen to be 10 mrad x cm and 4 mrad x cm to the horizontal and in the vertical planes correspondingly. The injection scheme suggested the usage of vertical septum-magnets with direct-current magnetic field and the radial bump of a kicker magnet. 1 ref., 2 tabs., 3 figs.

24321 (JINR-D–9-92-455, pp. 401-404) **HP - 2000. Present status.** Androsov, V.P. (UNTs Khar'kovskogo Fiziko-Tekhnicheskogo Instituta, Kharkov (Ukraine)); Bulyak, E.V.; Gladkikh, P.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Present status of the development and testing of the HP - 2000 stretcher separate systems is given. R and D project of the ring vacuum system is developed. The production of the equipment for dipole magnet chamber forming has begun. The 100 kw, 699.3 MHz klystron is produced and tested. The full-scale functional model of a five-resonator accelerating section is produced. Beam position monitors are produced too. 3 refs., 1 fig.

24322 (JINR-D–9-92-455, pp. 405-408) **Longitudinally polarized electron beam at the internal target of the pulse stretcher ring HP - 2000.** Zelinskij, A.Yu. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The scheme designed for the production of a linear-polarized electron beam in the interaction point with the internal target of the HP - 2000 stretcher ring in the range of electrons of 0.5 - 3 GeV is described. The designs of a solenoidal spin-rotator of the injection channel and the 'Siberian snake' are developed. 6 refs., 3 figs.

24323 (JINR-D–9-92-455, pp. 413-415) **Dynamic aperture measurement at the H-100 Kharkov storage ring.** Zelinskij, A.Yu. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)); Mocheshnikov, N.I.; Reprintsev, L.V.; Shcherbakov, A.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Results of measuring dynamic aperture of the Kharkov 100 - MeV H - 100 electron storage ring are presented. Beam lifetime depending on the variation of geometric aperture has been measured. The dynamic aperture is measured by means of incoherent betatron oscillation excitation induced by magnetic field pulses which repetition rate was chosen lesser than betatron oscillation frequency and the duration less than rotation period. Thus for radial plane the measured aperture is 7 mm which coincide well with measurements during shutters position variation. 4 refs., 2 figs.

24324 (JINR-D–9-92-455, pp. 416-418) **Status of the ROKK - 1 M facility at the VEPP - 4 M storage ring.** Kezerashvili, A.M. (RAN Sibirskoe Otdelenie, Inst Yadernoj Fiziki im. G.I.Budkera, Novosibirsk (Russian Federation)); Milov, A.M.; Muchnoj, N.Yu.; Usov, A.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The description of the ROKK - 1 M facility (backscattered compton photons) which is under construction at the VEPP - 4 M and designed for experiments with using laser photons compton backscattering on high-energy electrons is presented. The ROKK - 1 M is designed for providing operative measurement of electron polarization at the storage ring with the accuracy of 10% during 30 s. The laser system comprises two Nd : YAG lasers operating at the fundamental wave length of 106 nm and at the double wave length of 532 nm. Laser radiation optical optical transport channel length is 40 m and 60 m -for electron and positron directions correspondingly. 1 fig.

24325 (JINR-D–9-92-455, pp. 427-430) **Experimental study on collective effects in the VEPP - 3 storage ring in centimeter length range of a bunch.** Belomestnykh, S.A. (RAN Sibirskoe Otdelenie, Inst Yadernoj Fiziki im. G.I.Budkera, Novosibirsk (Russian Federation)); Voroshilov, A.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The behaviour of a charged particle bunch in the range of its length of several centimeters at the VEPP - 3 during high current accumulation is studied. The bunch length, its cross-section dimension and equilibrium phase shift depending on current at different energies have been measured. The measured bunch length to current ratio is well coincide with theoretical prediction of the elongation by solving the balance equation where real and imaginary parts of impedance are comparable between each other. The bunch heating with current increase was not observed. The value of wide-band longitudinal impedance having inductive and resistive components is determined. 7 refs., 1 tab., 6 fogs.

24326 (JINR-D–9-92-455, pp. 431-434) **Preparation to the experiment on two-beam acceleration at the JINR High-Energy Physics Laboratory.** Bulanov, V.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Golubev, I.I.; Kaminskij, A.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

The status of a two-beam accelerating facility basic elements is considered. The facility comprises the 1.5 MeV LIU - 3000 induction linac having the designed beam current of 75 A and beam

power of 10 MW, free-electron laser (FEL), an injector and a high-gradient accelerating structure. The results of first experiments at FEL in the mode of amplification and generation are presented. 6 refs., 1 tab.

24327 (JINR-D–9-92-455, pp. 460-463) **Ion drift in electron beams.** Bulyak, E.V. (Khar'kovskij Fiziko-Tekhnicheskij Inst, Kharkov (Ukraine)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Effects induced during intense electron beam interaction with accumulated positive ions of a residual gas at an electron storage ring are considered. Estimates of ion skeleton density depending on residual gas density at the presence of ion removal plates are presented. Ion density distribution in axial plane in respect to beam orbit is considered. 3 refs., 2 figs.

24328 (LBL–35890) **A design method for multiple tube gas-cooled electrical leads for the g-2 superconducting magnets.** Green, M.A. (Lawrence Berkeley Lab., CA (United States)); Jia, L.X.; Addessi, L.J.; Cullen, J.R. Jr.; Esper, A.J.; Meier, R.E. Lawrence Berkeley Lab., CA (United States). Dec 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016 ; AC03-76SF00098. (CONF-950722–2: Cryogenic engineering conference and international cryogenic materials conference, Columbus, OH (United States), 17-21 Jul 1995). Order Number DE95014787. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a method for designing 5300 A gas cooled electrical leads for the g-2 solenoids and 2850 A leads for the g-2 self shielded inflector dipole magnet. Empirical design equations for annular tube gas cooled leads are presented. The leads are bundled tube leads which are cooled by helium flowing in annular cooling passages between tubes. Each tube in the bundle consists of nested circular copper tubes that can be cooled on both sides. Multiple current carrying tubes will increase the lead current capacity and cooling the tubes on both sides will increase lead efficiency for a given helium flow pressure drop. The design method presented here can applied to leads made from a variety of materials.

24329 (LS–109) **A positron accumulator ring for APS.** Crosbie, E.A. Argonne National Lab., IL (United States). Mar 1988. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95015571. Source: OSTI; NTIS; GPO Dep.

The new positron injection scheme is as follows. The cycle rate of the injector synchrotron is increased to 2 Hz. During 0.4 sec of each 0.5-sec synchrotron cycle, 24 linac pulses are injected into the horizontal phase space of the PAR at a 60-Hz rate. Each injected pulse occupies about 1/3 of the circumference of the accumulator ring. After 0.1 sec for longitudinal damping, the single accumulated bunch is transferred into one of the 352.96-MHz buckets of the injector synchrotron RF system. This single bunch is accelerated to 7 GeV and transferred into the storage ring while the PAR accumulates the next bunch of positrons. The injector synchrotron requires only the one high-frequency RF system.

24330 (LS–155) **3-D computer simulations of EM field sin the APS vacuum chamber. Part 2: Time-domain analysis.** Chou, W. Argonne National Lab., IL (United States). 20 Jan 1989. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95015572. Source: OSTI; NTIS; GPO Dep.

Our simulations suggest that the strong peak around 4 GHz in the narrow gap observed in the measurements is generated by TE modes. Therefore, one should not worry about this peak insofar as the coupling impedance is concerned. On the other hand, some discrepancies between our simulations and the measurements are noticed and remain to be resolved.

24331 (LS–177) **Loss parameter calculations.** Cook, J.M. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015497. Source: OSTI; NTIS; GPO Dep.

Sands and Rees propose an electronic bench measurement of the impulse energy loss of a stored particle bunch to vacuum-chamber components. The components act as the outer conductor of a coaxial line with a thin wire as center conductor. Short pulses are then transmitted through this coaxial system to simulate relativistic particle bunches. Their proposal has since been implemented by several investigators and has become a well-known technique. They derive a first-order approximation to the loss parameter κ for use in these measurements. The purpose of this note is to point out that exact expression for κ is as simple as its first-order approximation and to recommend its use even when κ is small.

24332 (LS–189) **Thermal and mechanical measurements of the prototype SR quadrupole.** Lopez, F. Argonne National Lab., IL (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015203. Source: OSTI; NTIS; INIS; GPO Dep.

The magnet warm-up time and motion of the alignment fiducials was investigated. Type K thermocouples were used to measure the temperature of the magnet steel, ambient, and supply and return H_2O. The vertical position of alignment targets was measured using optical levels. A laser position-sensitive laser detector was placed on top of the magnet, and the motion of the detector with respect to a laser (part of the Danfysik measurement bench) was recorded.

24333 (LS–214) **Fourth-integral resonance study on Aladin at SRC.** Liu, J. (Argonne National Lab., IL (United States)); Crosbie, E.; Teng, L.; Bridges, J.; Ciarlette, D.; Symon, K.; Trzeciak, W. Argonne National Lab., IL (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015393. Source: OSTI; NTIS; INIS; GPO Dep.

The fourth-integral betatron resonance driven by sextupoles was studied on the electron storage ring Aladdin at SRC. The resonance feature of capturing the phase space particles in the resonance islands was dearly demonstrated. In a computer simulation, the finite beam size is simulated by multi-particle tracking and the decoherence of the betatron oscillation was shown to agree well with experiment observation.

24334 (LS–220) **Survey and alignment report on the primary control network for the APS.** Friedsam, H.; Penicka, M.; Zhao, S. Argonne National Lab., IL (United States). Feb 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015211. Source: OSTI; NTIS; INIS; GPO Dep.

During November 1992 the survey and alignment team measured the entire primary control network for the APS. This task had to be finished before the enclosure of the EAA and the RF buildings were put in place, inhibiting several lines of sight necessary for the determination of the monument locations.

24335 (SLAC-PUB–95-6812) **Transport construction status and commissioning plans.** Fieguth, T. (and others); Bloom, E.; Donaldson, T. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ; AC03-76SF00098. (CONF-950512–188: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995; LBL–37045). Order Number DE95014650. Source: OSTI; NTIS; INIS; GPO Dep.

Installation of the PEP-II electron and positron Injection beamlines in the SLAC linac housing is now underway. Utilization of the existing high power, low emittance beams available at SLAC required that a great portion of the systems for pulsed extraction and transport of 9.0 GeV electrons and 3.1 GeV positrons for injection into the PEP-II rings will reside in the existing linac housing. Approximately 4.7 kilometers of these beamlines will be completed during the summer of 1995. All components, including orbit correctors and diagnostic instruments, required for extraction and transport of the electron beam will be in place and ready for commissioning as soon as this fall. The positron transport line in the

housing will also be complete except for the pulsed extraction system. These systems are described, along with the status of the construction and installation of the important subsystems such as magnets and power supplies, vacuum systems, instrumentation and controls. The plan for commissioning is discussed.

24336 (SLAC-PUB–95-6897) **High-power RF window and coupler development for the PEP-II B Factory.** Neubauer, M. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Fant, K.; Hodgson, J.; Judkins, J.; Schwarz, H.; Rimmer, R.A. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ; AC03-76SF00098. (LBL–37250; CONF-950512–174: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013377. Source: OSTI; NTIS; INIS; GPO Dep.

We describe the fabrication and testing of the RF windows designed to transmit power to the PEP-II 476 MHz cavities. Design choices to maximize the reliability of the window are discussed. Fabrication technologies for the window are described and finite-element analysis of the assembly process is presented. Conditioning and high-power testing of the window are discussed. Design of the coupler assembly including the integration of the window and other components is reported.

24337 (SLAC-PUB–95-6901) **Design of traveling wave windows for the PEP-II RF coupling network.** Kroll, N.M.; Ng, C.K.; Judkins, J.; Neubauer, M. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515 ; FG03-93ER40759. (CONF-950512–168: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013369. Source: OSTI; NTIS; INIS; GPO Dep.

The waveguide windows in the PEP-II RF coupling network have to withstand high power of 500 kW. Traveling wave windows have lower power dissipation than conventional self-matched windows, thus rendering the possibility of less stringent mechanical design. The traveling wave behavior is achieved by providing a reflecting iris on each side of the window, and depending on the configuration of the irises, traveling wave windows are characterized as inductive or capacitive types. A numerical design procedure using MAFIA has been developed for traveling wave windows. The relative advantages of inductive and capacitive windows are discussed. Furthermore, the issues of bandwidth and multipactoring are also addressed.

24338 (SLAC-PUB–95-6902) **Impedance spectrum for the PEP-II RF cavity.** Lin, X.E.; Ko, K.; Ng, C.K. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-950512–173: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013376. Source: OSTI; NTIS; INIS; GPO Dep.

The impedance spectrum presented by the PEP-II RF cavity to the beam is calculated using a 3D MAFIA model which includes the damping waveguides and the input coupler. The simulation assumes that all the ports leading out of the cavity, including the beam Pipes, are terminated in matched loads. The effect of the external loading on the longitudinal impedances will be examined. This study takes into account the input coupler damping which has not been considered in previous calculations.

24339 (UCRL-JC–119407) **Test results of a combined distributed ion pump/non-evaporable getter pump design developed as a proposed alternative pumping system for the PEP-II asymmetric B-Factory collider.** Holdener, F. (Lawrence Livermore National Lab., CA (United States)); Behne, D.; Hathaway, D. Lawrence Livermore National Lab., CA (United States); Stanford Linear Accelerator Center, Menlo Park, CA (United States). 24 Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ; AC03-76SF00515. (CONF-950512–249: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014389. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have built and tested an all-in-one combination plate-type distributed ion pump/non-evaporable getter pump design (DIP/NEG) considered as a proposed alternative pumping system for the PEP-II B-Factory High Energy Ring (HER). The DIP portion of the design used a Penning cell hole size of 12 mm in a mostly uniform magnetic field of 0.18 T. The NEG portion of the design used commercially available non-evaporable getter material type St-707™. A detailed description of the design is presented along with results of pumping speed measurements.

24340 (UCRL-JC–119408) **Test results of pre-production prototype distributed ion pump design for the PEP-II Asymmetric B-Factory collider.** Holdener, F.R. (and others); Behne, D.; Hathaway, D. Lawrence Livermore National Lab., CA (United States). 24 Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950512–213: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013265. Source: OSTI; NTIS; INIS; GPO Dep.

We have built and tested a plate-type pre-production distributed Ion Pump (DIP) for the PEP-II B-Factory High Energy Ring (HER). The design has been an earlier design to use less materials and to costs. Penning cell hole sizes of 15, 18, and 21 mm have been tested in a uniform magnetic field of 0.18 T to optimize pumping speed. The resulting final DIP design consisting of a 7-plate, 15 mm basic cell size anode was magnetic field of the HER dipole. A description of the final optimized DIP design will be presented along with the test results of the pumping speed measurements.

24341 (UCRL-JC–120158) **PEP-III magnet power conversion systems: Power supplies for large magnet strings.** Jackson, T. (Lawrence Berkeley Lab., CA (United States)); Saab, A.; Shimer, D. Lawrence Livermore National Lab., CA (United States); Stanford Linear Accelerator Center, Menlo Park, CA (United States); Lawrence Berkeley Lab., CA (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ; AC03-76SF00098 ; AC03-76SF00515. (CONF-950512–178: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95013425. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the cooperative design efforts of LBL, SLAC, and LLNL on the magnet power conversion systems for PEP-II. The systems include 900 channels of correction magnet bipolar supplies and 400 unipolar supplies in the range of 5 to 500 kW. We show the decision process and technical considerations influencing the choice of power supply technologies employed. We also show the development of specifications that take maximum advantage of both the resources available and existing facilities while at the same time satisfying tight constraints for cost control, scheduling and coordination of different working groups. Switch-mode power conversion techniques will be used extensively in these systems, from the corrector supplies to the largest units if the dynamic performance specifications demand it. General system descriptions for each of the power supply ranges and for a new common control system interface and regulator are included.

44 INSTRUMENTATION

Refer also to citation(s) 23991

4401 Radiation Instrumentation

Refer also to citation(s) 24188, 24238, 24324, 24773, 24774, 24775, 24811

24342 (ANL-HEP-TR–94-04) **A possible level 0 trigger scheme for the STAR EMC.** Underwood, D. Argonne National Lab., IL (United States). May 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013384. Source: OSTI; NTIS; INIS; GPO Dep.

We propose a level 0 trigger for the STAR Electromagnetic Calorimeter, EMC, which provides a global energy sum and sums over cells appropriate for triggering on direct gammas and jets. It is implemented in analog at low level and digitally with FPGA's at higher level. It will provide trigger information in less than 800 nanoseconds.

24343 (ANL-HEP-TR-95-39) **Technical specification for plate fabrication for the ATLAS Tile Hadron Calorimeter.** Hill, N.F. Argonne National Lab., IL (United States). 13 Jun 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015824. Source: OSTI; NTIS; INIS; GPO Dep.

The Atlas Collaboration, at the European Organization for Nuclear Research (CERN), proposes to build a general purpose proton-proton detector for the Large Hadron Collider (LHC), located in Geneva, Switzerland. The ATLAS collaboration consists of approximately 100 international institutions (universities and research laboratories) with a worldwide distribution. The ATLAS detector includes a large scintillating tile calorimeter using iron as the absorber material. This detector will be used to identify and measure the by-products of proton-proton collisions that occur at the symmetric center. The design of this detector is unique in that the absorber plates are oriented perpendicular to the colliding beam axis, rather than parallel, as is done in most other similar detectors to date. A simplified view of the detector is shown in the figure below.

24344 (ANL/IPNS/CP–86627) **Gas detectors for neutrons.** Crawford, R.K. Argonne National Lab., IL (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9506185–2: New tools for neutron instrumentation workshop, Les Houches (France), 6-10 Jun 1995). Order Number DE95013738. Source: OSTI; NTIS; INIS; GPO Dep.

The principles involved in gas detectors for neutrons and the techniques for position encoding in such detectors are reviewed. This forms the basis for a discussion of the limitations on gas detector position resolution and maximum data rates, and of the aging effects in such detectors. Current capabilities and possible areas for improvement are noted.

24345 (BNL–61687) **Temperature stimulated reverse annealing of neutron induced damage in high resistivity silicon detectors.** Li, Z. (Brookhaven National Lab., Upton, NY (United States)); Li, C.J.; Verbitskaya, E.; Eremin, V. Brookhaven National Lab., Upton, NY (United States). Mar 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-951073–1: IEEE nuclear science symposium and medical imaging conference, San Francisco, CA (United States), 21-28 Oct 1995). Order Number DE95012086. Source: OSTI; NTIS; INIS; GPO Dep.

Neutron irradiated high resistivity silicon detectors have been subjected to elevated temperature annealings (ETA). It has been found that both detector full depletion voltage and leakage current exhibit reverse annealing behavior for highly irradiated detectors: increase with ETA. Laser induced current shapes have indicated a net increase of acceptor type space charges associated with the full depletion voltage increase after ETA. Data of current deep level transient spectroscopy (I-DLTS) have shown that the dominant microscopic effect is the increase of a level at 0.39 eV. This level is tentatively identified as the V-V^- level at E_c-0.39 eV and/or the C_i-O_i level at E_v + 0.36 eV. Data of thermally stimulated current (TSC) have shown increases of levels at 0.26 eV and 0.40 eV with ETA, suggesting that the level responsible for the reverse annealing effects be the V-V center (V-V^- at E_c-0.25 eV and V-V^- at E_c-0.39 eV). Some local, non-uniform trappings of laser induced electrons and holes have been observed near the pt contact at low voltages after ETA at intermediate temperatures (110–150 °C).

24346 (CIEMAT–758) **Background characterization in a liquid scintillation spectrometer.** Rodriguez Barquero, L.; Los arcos, J.M.; Jimenez de Mingo, A. No corporate text available. 1995. 26p. (In Spanish). Order Number DE95780845. Source: OSTI; NTIS; INIS.

An alternate procedure for background count rate estimation in a liquid scintillation spectrometer is presented, which does not require to measure a blank with similar composition, volume and quench, to the problem sample. The procedure is based on a double linear parameterization which was obtained from a systematic study of the background observed with glass vials, in three different windows, 0-20 KeV, 0-800 KeV and 0-2 MeV, for volume between 2 and 20 ml of three commercial scintillators, Hisafe II, Ultima-gold and Instagel, and quenching degree in the interval equivalent to 50%-3% tritium efficiency. This procedure was tested with standard samples of ^{3}H, and led to average discrepancies less than 10% for activity => 0,6 Bq, against conventional methods for which the discrepancies are twice on average.

24347 (CONF-950209–10) **Non-conventional passive sensors for monitoring tritium on surfaces.** Gammage, R.B. (Oak Ridge National Lab., TN (United States). Health Sciences Research Div.); Brock, J.L.; Meyer, K.E. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. international symposium on field screening methods for hazardous wastes and toxic chemicals; Las Vegas, NV (United States); 22-24 Feb 1995. Order Number DE95013356. Source: OSTI; NTIS; INIS; GPO Dep. TTP/OR158102.

The authors describe development of small passive, solid-state detectors for in-situ measurements of tritium, or other weak beta-emitting radionuclides, on surfaces. One form of detector operates on the principle of thermally stimulated exoelectron emission (TSEE), the other by discharge of an electret ion chamber (EIC). There are currently two specific types of commercially available detector systems that lend themselves to making surface measurements. One is the thin-film BeO on a graphite disc, and the other is the Teflon EIC. Two other types of TSEE dosimeters (ceramic BeO and carbon doped alumina) are described but lack either a suitable commercially available reader or standardized methods of fabrication. The small size of these detectors allows deployment in locations difficult to access with conventional windowless gas-flow proportional counters. Preliminary testing shows that quantitative measurements are realized with exposure times of 1–10 hours for the TSEE dosimeters (at the DOE release guideline of 5,000 dpm/100 cm^2 for fixed beta contamination). The EIC detectors exhibit an MDA of 26,000 dpm/100 cm^2 for a 24 hour exposure. Both types of integrating device are inexpensive and reusable. Measurements can, therefore, be made that are faster, cheaper, safer, and better than those possible with baseline monitoring technology.

24348 (CONF-951073–2) **A flexible analog memory address list manager/controller for PHENIX.** Ericson, M.N.; Walker, J.W.; Britton, C.L.; Wintenberg, A.L.; Young, G.R. Oak Ridge National Lab., TN (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From IEEE nuclear science symposium and medical imaging conference; San Francisco, CA (United States); 21-28 Oct 1995. Order Number DE95012875. Source: OSTI; NTIS; INIS; GPO Dep.

A programmable analog memory address list manager/controller has been developed for use with all analog memory-based detector subsystems of PHENIX. The unit provides simultaneous read/write control, cell write-over protection for both a Level-1 trigger decision delay and digitization latency, and re-ordering of AMU addresses following conversion, at a beam crossing rate of 112 ns. Addresses are handled such that up to 5 Level-1 events can be maintained in the AMU without write-over. Data tagging is implemented for handling overlapping and shared beam event data packets. Full usage in all PHENIX analog memory-based detector sub-systems is accomplished by the use of detector-specific programmable parameters – the number of data samples per Level-1 trigger valid and the swnple spacing. Architectural candidates for the system are discussed with emphasis on implementation implications. Details of the design are presented including design simulations, timing information, and test results from a full implementation using programmable logic devices.

24349 (CONF-951073–4) **Post-radiation memory correction using differential subtraction for Phenix.** Britton, C.L. Jr.; Wintenberg, A.L.; Womac, M.; Kennedy, E.J.; Smith, R.S.; Young, G.R.; Awes, T.C. Oak Ridge National Lab., TN (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From IEEE nuclear science symposium and medical imaging conference; San Francisco, CA (United States); 21-28 Oct 1995. Order Number DE95012878. Source: OSTI; NTIS; INIS; GPO Dep.

In colliders such as RHIC, the radiation levels are well below those of colliders such as LHC. The problem is that there can be enough radiation at the inner detector (Multiplicity-Vertex Detector or MVD) to significantly affect a low-priced, nonradiation-hard

CMOS process. If the radiation affects the entire analog memory in a uniform fashion, then a real-time correction should be able to be performed to correct any changes seen in the memory and also the induced correlated noise from detector pickup thus precluding the need for a more expensive rad-hard process. This paper will present testing on memories fabricated in a 'soft' process and exposed to ionizing radiation. We used a single pipeline as a reference to be subtracted in a cell-by-cell basis from each pipe during read out and investigated the spatial effects of using different pipes for the reference. Use of this method reduced the noise which was common to all pipes (common-mode noise) and thus reduced both common-mode input noise and pattern noise generated from address lines being exercised on the AMU. The correlation across the memories (6-, 8-, and 16-channel AMUs fabricated in the Orbit 1.2μ CMOS process) vs. radiation dose was found to be quite good. Both pre-and post-radiation results are presented on systems designed for PHENIX and WA98 at CERN as well as measured results on the minimization of the effects of injected systematic noise.

24350 (CTH-RF–109) **Utilization of low voltage D-T neutron generators in neutron physics studies.** Singkarat, S. Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Reactor Physics. 1995. 98p. Order Number DE95632454. Source: OSTI; NTIS; INIS.

In a small nuclear laboratory of a developing country a low voltage D-T neutron generator can be a very useful scientific apparatus. Such machines have been used successfully for more than 40 years in teaching and scientific research. The original continuous mode 150-kV D-T neutron generator has been modified to have also a capability of producing 2-ns pulsed neutrons. Together with a carefully designed 10 m long flight path collimator and shielding of a 25 cm diameter · 10 cm thick BC-501 neutron detector, the pulsing system was successfully used for measuring the double differential cross-section (DDX) of natural iron for 14.1-MeV neutron from the angle of 30 deg to 150 deg in 10 deg steps. In order to extend the utility of the generator, two methods for converting the almost monoenergetic 14-MeV neutrons to monoenergetic neutrons of lower energy were proposed and tested. The first method uses a pulsed neutron generator and the second method uses an ordinary continuous mode generator. The latter method was successfully used to measure the scintillation light output of a 1.4 cm diameter spherical NE-213 scintillation detector. The neutron generator has also been used in the continuous search for improved neutron detection techniques. There is a proposal, based on Monte Carlo calculations, of using a scintillation fiber for a fast neutron spectrometer. Due to the slender shape of the fiber, the pattern of produced light gives a peak in the pulse height spectrum instead of the well-known rectangular-like distribution, when the fiber is bombarded end-on by a beam of 14-MeV neutrons. Experimental investigations were undertaken. Detailed investigations on the light transportation property of a short fiber were performed. The predicted peak has not yet been found but the fiber detector may be developed as a directional discrimination fast neutron detector. 18 refs.

24351 (DOE/ER/40678–T2) **Pressurized drift tubes scintillating fiber hadron calorimetry. Final report.** Bromberg, C. (and others); Huston, J.; Miller, R. Michigan State Univ., East Lansing, MI (United States). 22 Mar 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40678. Order Number DE95014541. Source: OSTI; NTIS; GPO Dep.

Under this contract members of the MSU high energy physics group constructed a full-scale Pressurized Drift Tube Chamber intended for the GEM muon system at the SSC. They achieved a position resolution of <90 μ over the full 5 m^2 area of the detector. This resolution satisfied the GEM resolution requirements of <100 μ by a comfortable margin. Based on their SSC work they developed a new technique for creating wire supports in drift tubes with an overall placement accuracy of <20 μ. This technique requires only simple jigging and can be duplicated and operated at low cost. Also, they participated in the design and testing of a hadron calorimeter prototype for GEM. This work lead the authors to develop a semi-automatic welding machine to fuse together two plastic optical fibers. Copies of this machine are currently in use in the CDF endplug upgrade at Fermilab and additional copies are used widely in calorimeter and fiber-tracker construction.

24352 (ENEA-RT-AMB–94-19) **Field parameters and operational quantities for ICRU sphere with reference photon beams: Monte Carlo and experimental evaluation of angular dependence of dose equivalent quantities. Part 4.** Morelli, B. (Bologna Univ. (Italy). Dipt. di Fisica); Gualdrini, G.F.; Monteventi, F. ENEA, Bologna (Italy). Area Energia Ambiente e Salute. Jul 1994. 150p. CEE F13P-CT920064H. Order Number DE95789775. Source: OSTI; NTIS (US Sales Only).

The present report is the last of four technical reports dealing with the characterization of photon radiation fields for the calibration of personal dosemeters. The analyses, carried out up to now on the ICRU sphere for five different x-ray reference series as stated by ISO (International Standard Organization) and by BIPM (Bureau International des Poids et Mesures), are concerned with a comprehensive study of air kerma backscatter factors for the ICRU sphere; the characterization of backscattered radiation field in terms of backscattered fluence spectrum and mean energy, with an additional study of the dependence on the incident angle; the theoretical and experimental study of the RS-1 tissue substitute material developed at the University of Gottingen; finally a study of the air kerma to directional dose equivalent conversion factors at the three depths of 0.07, 3 and 10 mm in the ICRU sphere, that are summarised in the present report. The results of the analysis in each specific case have been discussed by comparing them with the results obtained in analogous conditions in other European research laboratories and, whereas possible, with experimental data. The present work has been carried out under the CEC contract F13P-CT920064H and is connected with the activities of the EURADOS WG-4 (Numerical Dosimetry).

24353 (ENEA-RT-AMB–94-35) **Absolute measurement of radionuclide activity by sum-peak method: Standard procedures used at ENEA.** De Felice, P. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute). ENEA, Casaccia (Italy). Area Energia Ambiente e Salute. Dec 1994. 26p. Order Number DE95789742. Source: OSTI; NTIS (US Sales Only).

The sum-peak method is used at ENEA (Italian Agency for New Technologies, Energy and Environment) for the standardization of several radionuclides. The experimental apparatus, based on a NaI(Tl) well type detector, is described and the measurement procedure, for the particular case of the standardization of ^{125}I, is delineated.

24354 (FNAL/C–177-E) **The D0 Upgrade.** Abachi, S. D0 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jul 1995. 54p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);CEA, 75 - Paris (France);Russian Atomic Energy Commission, Moscow (Russian Federation);Conselho Nacional de Desenvolvimento Cientifico e Tecnolo DOE Contract AC02-76CH03000. (CONF-950705–1: HEP 95: international Europhysics conference on high-energy physics, Brussels (Belgium), 21-27 Jul 1995). Order Number DE95015356. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper we describe the approved DO Upgrade detector, and its physics capabilities. The DO Upgrade is under construction and will run during the next Fermilab collider running period in early 1999 (Run II). The upgrade is designed to work at the higher luminosities and shorter bunch spacings expected during this run. The major elements of t he upgrade are: a new tracking system with a silicon tracker, scintillating fiber tracker, a 2T solenoid, and a central preshower detector; new calorimeter electronics; new muon trigger and tracking detectors with new muon system electronics; a forward preshower detector; new trigger electronics and DAQ improvements to handle the higher rates.

24355 (FNAL-TM–1943) **Some tests of avalanche photodiodes produced by Advanced Photonix, Inc.** Foster, G.W. (Fermi National Accelerator Lab., Batavia, IL (United States)); Ronzhin, A.; Rusack, R. Fermi National Accelerator Lab., Batavia, IL (United States). Aug 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE95016647. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of the measurements presented here is to check some parameters of the high gain avalanche photodiodes (APD's) produced by Advanced Photonix, Inc. Samples with 16 mm and 5 mm diameter sensitive areas were tested. The tests were performed at FNAL. The new photomultiplier testing facility were used for gain measurements, linearity, and nonuniformity studies. The setup consists of laser with shifted wavelength of 440 nm, 10 Hz repetition rate and a pulse duration of 15 nsec. The laser light was transported to the APD by 1 mm diameter clear fiber. An amount of laser light was adjusted by rotating wheels of fixed light attenuation. The dynamic range of the APD, an amplifier (AMP) and an ADC was about 1000. To get the nonuniformity data the APD was mounted on a moveable stage under management and control of computer. The positioning of the fiber along sensitive surface of the APD was better than 100 microns.

24356 (HW–56696) **Application of neutron monitors to process control in Recuplex. Status report.** Kelly, P.R.; Hildreth, N.T. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 14 Jul 1958. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95014113. Source: OSTI; NTIS; GPO Dep.

A program was. initiated early in 1957 to develop a neutron monitor capable of detecting plutonium (Pu) concentration in process vessels in Recuplex. This followed an earlier application by Finished Products Operation and Research and Engineering of neutron monitoring to powder counting which had been successful and was being regularly used. The process vessel monitoring was to be done by the "in tank probe" method, utilizing the monitored solution as its own-moderator, and detecting the resulting slow and thermal neutrons with boron trifluoride (BF_3) type proportional counters. This report is intended to present the history of the Recuplex program; a summary of the development work to date; the current status of the monitoring system; and the immediate plans for future installations and work. This report is intended as a design guide for presently scheduled and future monitor installations in Recuplex and elsewhere of the types herein described. The report also includes calibration curves for both D-11 tank and H-3 column monitors, schematic representation of all installations, manual switching panel circuit diagram, pre-amplifier circuit diagram, probe well designs, and KI-2 instrument tank design.

24357 (JINR-D–13-92-581) **15. International symposium on nuclear electronics and International seminar CAMAC-92.** Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The proceedings of the 25. International symposium on nuclear electronics and the CAMAC-92 seminar are presented. The problems on creation of new effective systems for acquisition and processing the information in the field of high energies, spectroscopy and by radiation control at reactors are considered in the reports. Equipment interfaces, analogue-numerical converters, programmed controllers, etc, accomplished relative to the CAMAC and FASTBUS standards are described.

24358 (JINR-D–13-92-581, pp. 111-123) **Position sensitive neutron scintillation detectors for use at various european neutron sources.** Mueller, K.D. (Kernforschungsanlage Juelich GmbH (Germany)); Reinartz, R.; Reinhart, P.; Schaefer, W.; Tenten, W.; Schelten, J. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

Position-sensitive neutron-scintillation detectors of various arrangement and corresponding systems for data acquisition and processing are considered. The IBM computers compatible with EI SA PC, applied as pulse amplitude analyzer with $2x10^6$ channels, are used for the final data memorization. Brief description of multichannel pulse analyzer is given. Problems on application of the EI SA PC bus are considered. 8 refs.; 21 figs.

24359 (JINR-D–13-92-581, pp. 167-171) **Fast coder of analog signals.** Pilyar, A.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The basic characteristics of the fast analogue-to-digital converters and microschemes, on the basis whereof they are assembled, are presented. The eight-channel analogue-to-digital converter is developed in the FASTBus standard for measuring the fast-changing analogue signals. The fast coder is provided for the memory capacity of 256 four-digit words and access time not more than 10 ns. 9 refs.; 1 fig.; 1 tab.

24360 (JINR-D–13-92-581, pp. 188-192) **Application of VME bus for automation of high energy physics experimental installations in JINR.** Bazylev, S.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Smirnov, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The SPHERE spectrometer data acquisition system with application of the system kreit in the VME standard is considered. Unification of the recording electronics, data readout processors, processing, memory and interface processors into uniform system is accomplished on the basis of the 32-digit VME bus. Description and basic characteristics of single-play computers, used for the data processing, are presented. 6 refs.; 2 figs.

24361 (JINR-D–13-92-581, pp. 241-247) **The Event Builder module for the NORDBALL multidetector system.** Forycki, A. (Niels Bohr Inst., Copenhagen (Denmark)); Hoy-Christensen, P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

A new Event Builder hardware module has been developed in order to increase the throughput, decrease the dead time, simplify extensions and improve testability and maintainability of the NORDBALL data acquisition system. The module allows an easy implementation of multiple level trigger schemes. When triggered, the device concurrently reads event data through its three input ports (from NIM ADCs, CAMAC modules and multiple FERA-compatible subsystems), merges the data read into one event, adds the event and subevent headers and transmits the complete event to the triple port ECL/VME/VSB memory for subsequent preprocessing in a 32 bit multiprocessor VMEbus subsystem. Due to its parallel and pipelined architecture the hardware Event Builder is capable of collecting from the NORDBALL present electronics up to 50 000 160-byte events/sec. 16 refs.; 2 figs.

24362 (JINR-D–13-92-581, pp. 248-253) **Multidimensional spectrometric data acquisition system on the PC/AT base.** Bogdzel', A.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Nguen Chung Tuan. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

Inexpensive system for conducting multiparametric analysis in the nuclear physics experiments is developed on the basis of the PC-AT computer. The maximum number of registered parameters equals 8. The dimensionality of one makes it possible to accomplish the data equisition in multidimensional, unidimensional and combined modes. The time of recording one n-dimensional event constitutes $[1.3+1.1(n-1)]$ μs. 6 refs.; 4 figs.

24363 (JINR-D–13-92-581, pp. 254-258) **Multidetector system for spectrometric data recording and acquisition on the basis of the 64 k * 24 bit memory device.** Bran'kovski, E. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Ermakov, V.A.; Sirotin, A.P.; Chelnokov, M.L.; Shirokov, V.K. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The programmed detector device (PDD) for multidetector system of spectrometric information recording and acquisition on the basis of the 64 k * 24 bit memory is proposed. The PDD possibilities are considered and its flowsheet is also presented. The spectrometric information storage unit is able to operate with not more than 16 detectors. The maximum number of the time channels is equal to 4096. The pulse width from detectors is not less than 150 ns. The number of events recorded in one time channel for one detector equals not more than 255. 5 refs.; 3 figs.

24364 (JINR-D–13-92-581, pp. 259-262) **Data acquisition system for positron emission tomograph.** Borejko, V.F. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Grebenyuk, V.M.; Mar'in, N.A.; Mitsyn, G.V.; Sidorov, V.T. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The data acquisition system for positron emission tomograph, containing 512 organic scintillators, is described. The system consists of sixteen 16-channel shaping amplifiers, one unit for useful events selection and buffer storage device with capacity of 2x4 K 16-digit words. The shaping amplifiers are accomplished in the CAMAC standard and the buffer storage device in the IBM PC standard. The processing time for one event is equal to 500 ns. 1 ref.; 3 figs.

24365 (JINR-D–13-92-581, pp. 263-268) **Apparatus method for correction of the ballistic deficit and charge losses on impurities into germanium detectors.** Kalinin, A.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The existing apparatus methods for correction of ballistic deficit and charge losses on impurities in germanium detectors are considered. The correction of ballistic deficit through the Goulding-Landis method, the Hinshaw method and the correction method for triangular form signals is most efficient for improving energy resolution of gamma-spectrometers with large germanium detectors. The flowsheets for correction of the carrier capture effect are based on the information from the fast spectrometric channel. 8 refs.; 4 figs.

24366 (JINR-D–13-92-581, pp. 273-276) **Control system for a programmable multichannel high-voltage source.** Belosludtsev, D.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Karzhavin, V.Yu.; Khabarov, V.S.; Khabarov, S.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The control system for programmable multichannel high-voltage sources, utilized in the high-energy physics for various detectors power supply is presented. The system is based on the modular principle. The high-voltage channels control is accomplished either from the control board through a keyboard or by a program from one computer connected with the control board. The basic functions, which are performed by the control board, developed on the basis of a single-crystal microcontroller, are enumerated. The system provides for control of up to 4096 high-voltage channels. 4 refs.; 3 figs.

24367 (JINR-D–13-92-581, pp. 282-286) **Control by some operating mechanisms in experimental installations TEXT, DVR on the IBR-2, IBR-30 reactors.** Vladimirov, V.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Georgiev, D.; Zen En Ken; Lazin, V.I.; Ostrovnoj, A.I.; Petukhova, T.B.; Salamatin, I.M.; Sirotin, A.P.; Trepalin, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

Control units for pitch engines and operating mechanisms, applied in high-resolution diffractometers and MURN spectrometers installed in the IBR-2 and IBR-30 reactors are described. The program interfaces and adapters for the operating mechanisms control are considered. The control units are created on the basis of the PC in the CAMAC standard. 5 refs.; 2 figs.

24368 (JINR-D–13-92-581, pp. 287-290) **Automation of radiation monitoring on JINR reactors.** Arkhipov, V.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Ishmukhametov, M.Z.; Solodilov, A.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The system for radiation and dosimetric monitoring on the IBR-30 and IBR-2 reactors (JINR) reactors is described. The radiation monitoring system is developed on the basis of the PRAVETs-16 personal computer and contains two kreits in the CAMAC standard. The maximum distance between the computer and the kreit is equal to 500 m. The number of controlled information channels equals 150. The information exchange speed is 2400 bands. 6 refs.; 1 fig.

24369 (KURRI-TR–388) **Improvements and applications of multilayer neutron interferometer. 1. Precise neutron optics.** Otake, Yoshie (Ibaraki National Coll. of Technology, Hitachinaka (Japan)); Ebisawa, Toru (eds.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1994. 89p. (In Japanese, English). (CONF-9311320–: Workshop on high precision neutron optics, Kumatori (Japan), 10 Nov 1993). Order Number DE95789430. Source: OSTI; NTIS; INIS.

This issue is the collection of the papers presented at the title meeting. The 11 of the presented papers are indexed individually. (J.P.N.).

24370 (LA–12893-C, pp. 315-323) **GHz nuclear magnetic resonance.** Cross, T.A.; Drobny, G.; Trewhella, J. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

For the past dozen years, 500- and 600-MHz spectrometers have become available in many laboratories. The first 600-MHz NMR spectrometer (at Carnegie Mellon University) was commissioned more than 15 years ago and, until 1994, represented the highest field available for high-resolution NMR. This year, we have witnessed unprecedented progress in the development of very high field magnets for NMR spectroscopy, including the delivery of the first commercial 750-MHz NMR spectrometers. In addition, NMR signals have been obtained from 20-Tesla magnets (850 MHz for ^1H's) at both Los Alamos National Laboratory and Florida State University in the NHMFL (National High Magnetic Field Laboratory). These preliminary experiments have been performed in magnets with 100-ppm homogeneity, but a 20-Tesla magnet developed for the NHMFL will be brought to field this year with a projected homogeneity of 0.1 ppm over a 1-cm-diam spherical volume.

24371 Apparatus and method for detecting gamma radiation. Sigg, R.A. 1993. Filed date 25 May 1993. U.S. Patent Application 8-066,235. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95015047. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of a high efficiency radiation detector for measuring X-ray and gamma radiation from small-volume, low-activity liquid samples with an overall uncertainty better than 0.7% (one sigma SD). The radiation detector includes a hyperpure germanium well detector, a collimator, and a reference source. The well detector monitors gamma radiation emitted by the reference source and a radioactive isotope or isotopes in a sample source. The radiation from the reference source is collimated to avoid,attenuation of reference source gamma radiation by the sample. Signals from the well detector are processed and stored, and the stored data is analyzed to determine the radioactive isotope(s) content of the sample. Minor self-attenuation corrections are calculated from chemical composition data.

24372 (PNL-SA–26104) **A variety of neutron sensors based on scintillating glass waveguides.** Bliss, M.; Craig, R.A. Pacific Northwest Lab., Richland, WA (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9505240–1: Pacific NW fiber optic sensor conference, Troutdale, OR (United States), 3-4 May 1995). Order Number DE95014632. Source: OSTI; NTIS; INIS; GPO Dep.

Pacific Northwest Laboratory (PNL) has fabricated cerium-activated, lithium-silicate glass scintillating fiber neutron sensors via a hot-downdraw process. These fibers typically have a transmission length (e^{-1} length) of greater than 2 meters. The underlying physics of, the properties of, and selected devices incorporating these fibers are described. These fibers constitute an enabling technology for a wide variety of neutron sensors.

24373 (SSCL-Preprint–553) **Vertex detectors.** Lueth, V. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-9207140–8: Stanford Linear Accelerator Center (SLAC) summer institute on particle accelerators: third family and the physics of flavor, Stanford, CA (United States), 13-24 Jul 1992). Order Number DE95011156. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of a vertex detector is to measure position and angles of charged particle tracks to sufficient precision so as to be able to separate tracks originating from decay vertices from those produced at the interaction vertex. Such measurements are interesting because they permit the detection of weakly decaying particles with lifetimes down to 10^{-13} s, among them the τ lepton and charm and beauty hadrons. These two lectures are intended to introduce the reader to the different techniques for the detection of secondary vertices that have been developed over the past decades. The first lecture includes a brief introduction to the methods used to detect secondary vertices and to estimate particle lifetimes. It describes the traditional technologies, based on photographic recording in emulsions and on film of bubble chambers, and introduces fast electronic registration of signals derived from scintillating fibers, drift chambers and gaseous micro-strip chambers. The second lecture is devoted to solid state detectors. It begins with a brief introduction into semiconductor devices, and then describes the application of large arrays of strip and pixel diodes for charged particle tracking. These lectures can only serve as an introduction the topic of vertex detectors. Time and space do not allow for an in-depth coverage of many of the interesting aspects of vertex detector design and operation.

24374 (SSC-SR–1021) **Report of the Task Force on detector Research and Development for the Superconducting Super Collider.** Lawrence Berkeley Lab., CA (United States). SSC Central Design Group. Jun 1986. 315p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011083. Source: OSTI; NTIS; GPO Dep.

This report contains a: Report of the working group on tracking devices; report of the working group on calorimetry; report of the working group on muon, electron and hadron identification; report of the working group on electronics, triggering, data acquisition and computing; report of the working group on superconducting magnets; and report of the working group on Monte Carlo development.

24375 (UCRL-ID–120286) **Monte Carlo study of a high-sensitivity gamma-ray detection system.** Decman, D.J.; Namboodiri, M.N. Lawrence Livermore National Lab., CA (United States). Mar 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015417. Source: OSTI; NTIS; INIS; GPO Dep.

The authors use Monte Carlo calculations to study a new design for a high-sensitivity gamma-ray detection system. The system uses an array of high-purity germanium detectors operating with an event-mode data acquisition system. The calculations show that the proposed design could produce a factor of 10 increase in the sensitivity of these measurements compared to currently employed systems.

24376 (UCRL-ID–120307) **Interim cryo-cooler/detector report.** Neufeld, K. (Lawrence Livermore National Lab., CA (United States)); Ruhter, W.; Anderson, E. Lawrence Livermore National Lab., CA (United States). 19 Apr 1995. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015850. Source: OSTI; NTIS; GPO Dep.

This report describes development of an electronic system designed to reduce vibration generated by a cryocooler. The diminished vibration makes it practical to use the active cooler to extract heat from a portable gamma ray detector instrument. The system was developed for a Sunpower cryocooler with an integrated counterbalance mass. The overall momentum cancellation approach is also applicable to other similar cryocoolers. The cancellation system is an assembly of several components tailored to accomplish the required vibration reduction with minimum power consumption and volume. It is designed to be powered by a 18–32 Volt battery. Up to ten harmonics of the 58.65 Hz drive frequency are controlled. In addition to the vibration cancellation, the electronic system produces the drive signal for the cryocooler and regulates the cooler temperature. The system employs a sinusoidal drive to reduce the amount of higher harmonic vibration. A digital signal processor (DSP) is used to perform the high speed vibration control. The Texas Instruments TMS320C31 processor is housed on a third-party board. A second board has analog-to-digital (A/D) and digital-to-analog (D/A) converters. The DSP was programmed in C. The physical system consists of two sets of electronics. The first is housed in a case that is separate from the detector unit.

24377 (UCRL-ID–121571) **Physics with the collider detectors at RHIC and the LHC.** Thomas, J.; Hallman, T. (eds.). Lawrence Berkeley Lab., CA (United States). 15 Jul 1995. 212p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950198–: Physics with the collider detectors at Relavitistic Heavy Ion Collider (RHIC) and the LHC, Livermore, CA (United States), 8 Jan 1995). Order Number DE95015976. Source: OSTI; NTIS; INIS; GPO Dep.

On January 8, 1995, over 180 participants gathered to hear the QM95 preconference workshop on 'Physics with the Collider Detectors at RHIC and the LHC'. The goal was to bring together the experimentalists from a wide community of hadron and heavy ion collider detector collaborations. The speakers were encouraged to present the current status of their detectors, with all the blemishes, and the audience was encouraged to share their successes and failures in approaching similar detector design issues. The presentations were excellent and the discussions were lively and stimulating. The editors hope that the reader will find these proceedings to be equally stimulating. Separate abstracts have been submitted to the energy database from articles in this report.

24378 (UCRL-JC–118290) **MID-IR detection: Detector circuitry and noise.** Blum, A. (and others); Gates, A.; Montoya, M. Lawrence Livermore National Lab., CA (United States). Jul 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9404162–21: 1994 chemical analysis by laser interrogation of proliferation effluents (CALIOPE ITR) interim technical review, Livermore, CA (United States), 26-28 Apr 1994). Order Number DE95014159. Source: OSTI; NTIS; GPO Dep.

Our ability to measure the spectral transmission of the atmosphere is limited in two ways. First, by noise that is added to the returning signal by random processes such as electronic noise and the random emission of IR photons. Second, by speckle that acts as a wavelength dependent multiplier of the returning signal amplitude. In this paper we report our estimates of the effects of added random noise on the measurements planned for the October field tests. We do not consider speckle which is fundamentally different from "additive noise" and is being separately considered by others. The system which will be fielded by LLNL in October '94 will transmit on and off resonance wave-lengths $\lambda 1$ and $\lambda 2$. The integral of the returning signal as well as an integral of the transmitted signal will be recorded at each wavelength. From these the transmission can be calculated. The two returning wavelengths are separated in a spectrograph and sent to detectors in a 16-element array. Each detector is followed by an amplifier. To maintain good system linearity, nominally constant detector voltage, and large dynamic range, it is desirable that the amplifier input be a virtual ground. Either a linear transimpedance amplifier or negative feedback charge sensitive can satisfy this requirement. Two of the 16 amplifier outputs are selected by a multiplexer and passed to data processing and/or recording hardware. The charge sensitive amplifier integrates the arriving current and we need only record its output. The digital sampling (waveform capture) hardware can be used in a mode in which it records the integrated outputs.

24379 (UCRL-JC–119320) **The BaBar cesium iodide electromagnetic calorimeter.** Wuest, C.R. Lawrence Livermore National Lab., CA (United States). Dec 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410317–4: IHEP: 1994 Beijing calorimetry symposium, Beijing (China), 25-27 Oct 1994). Order Number DE95011755. Source: OSTI; NTIS; GPO Dep.

The BABAR Cesium Iodide Electromagnetic Calorimeter is currently in the technical design stage. The calorimeter consists of approximately 10,000 individual thallium-doped cesium iodide crystals arranged in a near-hermetic barrel and endcap structure. Taking previous cesium iodide calorimeters as a benchmark, we hope to build a system with roughly two times better energy resolution. This will be achieved by a combination of high quality crystal growing, precision mechanical processing of crystals and support structure, highly efficient light collection and low noise readout electronics. The calorimeter described here represents the current state of the design and we are undertaking an active period of optimization before this design is finalized. We discuss here the physics motivation, the current design and options for optimization.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 24345

4405 Thermal Instrumentation

Refer also to citation(s) 24436, 24437

24380 (CONF-950793–6) **Coherent infrared imaging camera (CIRIC).** Hutchinson, D.P.; Simpson, M.L.; Bennett, C.A.; Richards, R.K.; Emery, M.S.; Crutcher, R.I.; Sitter, D.N. Jr.; Wachter, E.A.; Huston, M.A. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 40. annual meeting of the Society of Photo-Optical Instrumentation Engineers: international symposium on optical science, engineering and instrumentation; San Diego, CA (United States); 9-14 Jul 1995. Order Number DE95014595. Source: OSTI; NTIS; GPO Dep.

New developments in 2-D, wide-bandwidth HgCdTe (MCT) and GaAs quantum-well infrared photodetectors (QWIP) coupled with Monolithic Microwave Integrated Circuit (MMIC) technology are now making focal plane array coherent infrared (IR) cameras viable. Unlike conventional IR cameras which provide only thermal data about a scene or target, a coherent camera based on optical heterodyne interferometry will also provide spectral and range information. Each pixel of the camera, consisting of a single photosensitive heterodyne mixer followed by an intermediate frequency amplifier and illuminated by a separate local oscillator beam, constitutes a complete optical heterodyne receiver. Applications of coherent IR cameras are numerous and include target surveillance, range detection, chemical plume evolution, monitoring stack plume emissions, and wind shear detection.

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Refer also to citation(s) 23799, 24157, 24397, 24438, 24440, 24497, 24499, 24501, 24505, 24640, 24858, 24923

24381 (BNL–61332-(Rev.4/95)) **Flat panel planar optic display. Revision 4/95.** Veligdan, J.T. Brookhaven National Lab., Upton, NY (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950472–13: SPIE international symposium on aerospace/defense sensing and dual-use photonics, Orlando, FL (United States), 17-21 Apr 1995). Order Number DE95011781. Source: OSTI; NTIS; GPO Dep.

A prototype 10 inch flat panel Planar Optic display, (POD), screen has been constructed and tested. This display screen is comprised of hundreds of planar optic glass sheets bonded together with a cladding layer between each sheet where each glass sheet represents a vertical line of resolution. The display is 9 inches wide by 5 inches high and approximately 1 inch thick. A 3 milliwatt HeNe laser is used as the illumination source and a vector scanning technique is employed.

24382 (CONF-930346–6) **Initial data from a new High Spectral Resolution Lidar. Appendix A.** Eloranta, E.W.; Piironen, P.K. Wisconsin Univ., Madison, WI (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States);Nessling (Maj and Tor) Foundation;Joensuu Univ. (Finland). DOE Contract FG02-90ER61058. Grant N00014-91-J-1558. From Optical Society of America meeting on optical remote sensing of the atmosphere; Salt Lake City, UT (United States); 8-12 Mar 1993. Order Number DE95013016. Source: OSTI; NTIS; GPO Dep.

The University of Wisconsin High Spectral Resolution Lidar (HSRL) has been recently redesigned for operation in an electronics semitrailer van. The HSRL can now be deployed in support of field experiments. This paper presents initial observations with the new configuration along with an analysis of measurement accuracy. New measurement capabilities have been added. These include: observation of the signal variation with angular field of view, and observation of depolarization in all data channels. Depolarization measurements have been implemented by transmitting orthogonal linear polarizations on alternate laser pulses. Pulses are transmitted at 250 μs intervals such that the lidar observes the same ensemble of particles for both polarizations. Orthogonal polarizations are measured with a single detector per channel. Since the optical components and detector gains are identical for the two polarizations the measured depolarization ratios are independent of these factors and the system delivers very precise depolarizations. A new data channel with a computer controlled aperture allows measurements of multiple scattering as a function of receiver field of view. Since the field of view variation is dependent on the size of the scattering particles it is expected that this will allow remote measurements of cloud particle size. Other technical improvements in the new system include active control of spectrometer temperatures, greatly increased mechanical stability, an increased receiver aperture, injection of calibration signals into the signal profiles to allow continuous monitoring of system calibration drifts, and extensive computer control of system operations.

24383 (DOE/METC/C–95/7186) **Single port access holographic particle image velocimetry.** Woodruff, S.D. (USDOE Morgantown Energy Technology Center, WV (United States)); Richards, G.A.; Cha, D.J. USDOE Morgantown Energy Technology Center, WV (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). (CONF-950853–6: ASME/JSME annual summer meeting of the Fluids Engineering conference, Hilton Head, SC (United States), 13-17 Aug 1995). Order Number DE95014564. Source: OSTI; NTIS; GPO Dep.

An optical system, which requires only a single optical window mounted on a test volume, is proposed for holographic particle image velocimetry (HPIV). The optical system is a derivative of the double-exposure, double-reference-beam, off-axis HPIV system, but the innovative idea behind the system is to use back scattered light from the particles as the object wave. A 45° beam splitter inserted in front of the window serves to admit the illuminating beam and extract the back scattered light. This concept can be of great engineering interest because optical access is often limited to one window in practical devices. The preliminary results of the technique appear quite promising, with current studies aimed at defining the optical resolution capabilities.

24384 (ENEA-RT-AMB–93-23) **In situ laser scattering for analysis of spherical aerosol particles.** Neri, E. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute). ENEA, Casaccia (Italy). Area Energia Ambiente e Salute. Mar 1994. 31p. (In Italian). Order Number DE95789706. Source: OSTI; NTIS (US Sales Only).

The operation features of an in situ laser light scattering spectrometer that performs the analysis of spherical aerosol particles without sampling them out of the main stream, are described. The spectrometer is conceived to the purpose of examining individual particles, primarily within the 0.1 - 3.0 μm size range, whatever the refractive index is. The issue is attained by the simultaneous measurement and analysis of the angular intensity distribution of the laser radiation (lamda = 514.5 nm) scattered by each particle. The proper selection of the collection angles, in the scattering plane, has been made to the end of optimizing the size spectral resolution of the instrument, in relation to the size range of interest. The use of a set of different slits allows to finely adjust the size of the scattering volume (Vs). In this way, it can afford the handling of up to 10^6 part/cm^3, in single particle mode. The control over the quality of the angular sampling of the radiation scattered by the particles is based upon the analysis of the signal shape, continuously monitored at the 90^0 PMT output. The results obtained by performing the realistic simulation of the optical system, showed us that the convergence of the fitting procedure (X^2 minimization program) can be attained, provided that the data collected at the selected angles are affected by a percentage error of the order of 10%.

24385 (ORNL/TM–12978) **The least squares fit of a hyperplane to uncertain data.** Reister, D.B. Oak Ridge National Lab., TN (United States). May 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013508. Source: OSTI; NTIS; GPO Dep.

The authors became interested in this problem because they wanted to calibrate their laser range cameras. Laser range cameras are powerful tools for defining the Cartesian coordinates of surfaces of objects in an environment. The camera scans a laser beam over a scene and determines the distance (τ) by the time required for the beam to reach an object and return. The beam is directed back and forth (ϕ) and up and down θ by two rotating mirrors. Thus, the data measured by the camera has the form (τ, ϕ, θ). The geometry of the camera can be used to map the measured data to Cartesian coordinates (x, y, z). Since the geometry of the camera may not be known precisely, the cameras can be calibrated by comparing the calculated surface shapes to the known surface shapes. The most simple surface is a plane and many physical objects have planar surfaces. Thus, an important problem in the calibration of range cameras is to find the best (least squares) fit of a plane to a set of 3D points. For many least squares problems, the uncertainty is in one of the variables [for example, y = f(x) or z = f(xy)]. However, for some problems, the uncertainty is in the geometric transformation from measured data to Cartesian coordinates and all of the calculated variables are uncertain. The authors have formulated a constrained optimization problem to determine the least squares fit of a hyperplane to uncertain data. The first order necessary conditions require the solution of an eigenvalue problem. They have shown that the solution satisfies the second order conditions (the Hessian matrix is positive definite). Thus, the solution satisfies the sufficient conditions for a local minimum. They have performed numerical experiments that demonstrate that the solution is superior to alternative methods.

24386 Fiber optic probe having fibers with endfaces formed for improved coupling efficiency. O'Rourke, P.E.; Livingston, R.R. 1993. Filed date 4 May 1993. U.S. Patent Application 8-056,390. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95015102. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of a fiber optic probe for detecting scattered light, with transmitting and receiving fibers having slanted ends and bundled together to form a bevel within the tip of the probe. The probe comprises a housing with a transparent window across its tip for protecting the transmitting and receiving fibers held therein. The endfaces of the fibers are slanted, by cutting, polishing and the like, so that they lie in a plane that is not perpendicular to the longitudinal axis of the respective fiber. The fibers are held in the tip of the probe using an epoxy and oriented so that lines normal to the slanted endfaces are divergent with respect to one another. The epoxy, which is positioned substantially between the transmitting and receiving fibers, is tapered so that the transmitting fiber, the epoxy and the receiving fiber form a bevel of not more than 20 degrees. The angled fiber endfaces cause directing of the light cones toward each other, resulting in improved light coupling efficiency. A light absorber, such as carbon black, is contained in the epoxy to reduce crosstalk between the transmitting and receiving fibers.

24387 Magnetron cathodes in plasma electrode pockets cells. Rhodes, M.A. 1993. Filed date 10 May 1993. U.S. Patent Application 8-058,844. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015101. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of Magnetron cathodes, which produce high current discharges and form greatly improved plasma electrodes on each side of an electro-optic crystal. The plasma electrode comprises a low pressure gas region on both sides of the crystal. When the gas is ionized, e.g., by a glow discharge in the low pressure gas, the plasma formed is a good conductor. The gas electrode acts as a highly uniform conducting electrode. Since the plasma is transparent to a high energy laser beam passing through the crystal, the plasma is transparent. A crystal exposed from two sides to such a plasma can be charged up uniformly to any desired voltage. A typical configuration utilizes helium at 50 millitorr operating pressure and 2kA discharge current. The magnetron cathode produces a more uniform plasma and allows a reduced operating pressure which leads to lower plasma resistivity and a more uniform charge on the crystal.

24388 An analog edge detector with simultaneous background suppression. Munroe, J.L. 1993. Filed date 27 May 1993. U.S. Patent Application 8-067,912. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015043. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of an analog edge detector that utilizes masking techniques to provide modulation of spatial frequencies of interest, while suppressing other frequencies. A mask defining two or more subapertures is placed in close proximity to one or more apertures. The placement of the subapertures within the mask determines the frequency range to be modulated. In order to scan all directions, the mask can be rotated about the optical axis of the one or more apertures. As the subapertures are placed sparsely within the mask, the completely covered portions of the one or more apertures could be discarded, greatly reducing the weight of the apparatus. Subsequent image processing can include transform lenses to provide a Fourier transform of the image, and a spatially filtered image. A dc block can be used to block the near zero frequencies. A neural network or an optical correlometer can be connected to receive the Fourier transform image or the spatially filtered image for processing and output.

24389 (PNL-SA–26103) **Large-area fiber-optic chemical sensors.** Bliss, M.; Craig, R.A. Pacific Northwest Lab., Richland, WA (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9505240–2: Pacific NW fiber optic sensor conference, Troutdale, OR (United States), 3-4 May 1995). Order Number DE95014633. Source: OSTI; NTIS; GPO Dep.

Pacific Northwest Laboratory is developing a large-area chemical sensor that combines chemically selective coatings and optical

spectroscopy to detect target compounds. The chemically selective material is incorporated into the cladding of an optical fiber waveguide. The material is interrogated using optical spectroscopic techniques to determine the concentration of target compounds. The optical interrogation method includes two spectroscopies: visible-near infrared absorption spectroscopy and Raman spectroscopy. This work develops the physical and mathematical models of such a sensor and provides a set of tools with which to make design predictions for the large-area chemical sensors. The theoretical relationships derived herein allow the use of bulk absorption parameters and bulk Raman coefficients to predict sensor performance.

24390 (PNL-SA–26254) **Pacific Northwest Laboratory CALIOPE overview.** McDowell, R.S.; Kelly, J.F.; Sharpe, S.W. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9503149–6: 2. chemical analysis by laser interrogation of proliferation effluents (CALIOPE) meeting, Albuquerque, NM (United States), 28-30 Mar 1995). Order Number DE95014174. Source: OSTI; NTIS; GPO Dep.

This overview covers progress in the following areas in which Pacific Northwest Laboratory contributes to the CALIOPE Program: (1) Fabrication of electro-optic modulators to generate FM-coding on IR lasers in the 8-12 and 3-5 μm regions. (2) IR spectroscopy of signature species, abnormal isotopic distributions, hydrolysis and kinetics of effluents interacting with the atmosphere, and reflectance measurements of natural surfaces. (3) Systems analysis of FM-DIAL concepts, including lateral phase coherence and MTF measurements, and laboratory tests of detector technology and demodulation methods. (4) Field tests of FM-DIAL, covering field validation of portable diode laser concepts, FM-CO_2 interrogation of Hanford sites, and signal returns from natural specular surfaces. (5) Ancillary matters: ground-truthing at Hanford (and RSTR?), countermeasures, and new laser design concepts.

24391 (SAND–95-1306C) **Phosphors for flat panel emissive displays.** Anderson, M.T.; Walko, R.J.; Phillips, M.L.F. Sandia National Labs., Albuquerque, NM (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950401–14: 97. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 30 Apr - 1 may 1995). Order Number DE95014218. Source: OSTI; NTIS; GPO Dep.

An overview of emissive display technologies is presented. Display types briefly described include: cathode ray tubes (CRTs), field emission displays (FEDs), electroluminescent displays (ELDs), and plasma display panels (PDPs). The critical role of phosphors in further development of the latter three flat panel emissive display technologies is outlined. The need for stable, efficient red, green, and blue phosphors for RGB fall color displays is emphasized.

24392 (UCRL-CR–119635) **Fatigue expectations in a molybdenum/silicon multilayer under pulsed soft X-ray radiation.** Weber, F.J. (Oregon State Univ., Corvallis, OR (United States)); Kassner, M.E.; Stearns, D.G. Lawrence Livermore National Lab., CA (United States). 19 Jan 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014123. Source: OSTI; NTIS; INIS; GPO Dep.

The temperature rise in a Mo/a-Si multilayer x-ray reflective film due to radiation absorption is modeled for the first condenser mirror in a projection lithography system such as the one designed by the Advanced Microtechnology Program at LLNL. The radiation load is pulsed at 1000 Hz with a time average intensity of 500mW/cm^2. This intensity is the expected maximum on the first condenser mirror. The temperature rise is calculated using the integral transform technique. The film is assumed to have the thermal properties of its poorly conducting substrate, yielding a more conservative (higher) temperature estimate. The surface temperature rise is found to range between 35.6°C and 76.3°C. The stress due to this rise is greatest in the molybdenum film and ranges between 73MPa and 166MPa compressive. This fluctuating stress level, however, is believed to be insufficient, by a factor of five or so, to cause fatigue failure of the film.

24393 (UCRL-ID–119254) **An expanded porphyrin approach toward transactinium chelation and the development of porphyrin-coated optical fibers as potential actinide sensors.** Klunder, G. (Lawrence Berkeley Lab., CA (United States)); Silva, R. Lawrence Livermore National Lab., CA (United States). Dec 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015847. Source: OSTI; NTIS; GPO Dep.

Characterization of the contamination at DOE waste sites and facilities is necessary during environmental restoration. Characterization of toxic waste in containers and storage tanks is needed for effective waste management. Therefore, analytical and monitoring systems are needed for real-time analysis and feedback. The development of in-situ methods to measure chemical properties by specialized instrumentation capable of real-time analysis, without sacrificing sensitivity, has been identified as an area of needed development. Absorption spectroscopy is widely used and considered to be one of the most reliable techniques available for the qualitative and quantitative determination of sample composition. With the advancements in fiber optic technology, using light for remote in-situ sensing of groundwater contaminants has become practical. Significant progress has been made in the area of fiber-optic chemical sensors as can be seen by the number of recent review articles. The objective of this work is to develop a remote sensor for real-time measurement of actinides and concentrations in environmental or process waters based on absorption spectroscopy using internal reflection spectroscopy. Porphyrin coated silica wafers were prepared and the sensitivity and selectivity to actinides was determined.

24394 (UCRL-JC–118195) **Spectroscopy and decay kinetics of Pr^{3+}-doped chloride crystals for 1300-nm optical amplifiers.** Page, R.H. (and others); Schaffers, K.I.; Wilke, G.D. Lawrence Livermore National Lab., CA (United States). 9 Mar 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950101–6: Advanced solid-state laser conference, Memphis, TN (United States), 29 Jan - 1 feb 1995). Order Number DE95014369. Source: OSTI; NTIS; INIS; GPO Dep.

Several Pr^{3+}-doped chloride crystals have been tested spectroscopically for suitability as 1300-nm optical amplifiers operating on the $^1G_4$ - $^3H_5$ transition. $^1G_4$ lifetimes are much longer than in fluoride hosts, ranging up to 1300 μsec and suggesting a near-unity luminescence quantum yield. Emission spectra are typically broad (FWHM $\sim$ 70 nm) and include the 1310-nm zero-dispersion wavelength of standard telecommunications fiber.

24395 (UCRL-JC–119165) **Infrared hyperspectral imaging results from vapor plume experiments.** Bennett, C.L. (and others); Carter, M.R.; Fields, D.J. Lawrence Livermore National Lab., CA (United States). 17 Apr 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950472–12: SPIE international symposium on aerospace/defense sensing and dual-use photonics, Orlando, FL (United States), 17-21 Apr 1995). Order Number DE95014392. Source: OSTI; NTIS; GPO Dep.

In this article, recent measurements made with LIFTIRS, the Livermore Imaging Fourier Transform InfraRed Spectrometer, are presented. The experience gained with this instrument has produced a variety of insights into the tradeoffs between signal to noise ratio (SNR), spectral resolution and temporal resolution for time multiplexed Fourier transform imaging spectrometers. This experience has also clarified the practical advantages and disadvantages of Fourier transform hyperspectral imaging spectrometers regarding adaptation to varying measurement requirements on SNR vs. spectral resolution, spatial resolution and temporal resolution.

24396 (UCRL-JC–119627) **Advanced source studies on laser produced plasmas for EUV lithography.** Spitzer, R.C.; Gaines, D.P. Lawrence Livermore National Lab., CA (United States). 19 Jan 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409177–15: Optical Society of America conference on extreme ultraviolet lithography, Monterey, CA (United States), 19-21 Sep 1994). Order Number DE95014677. Source: OSTI; NTIS; GPO Dep.

Laser-produced plasmas are source candidates for EUV lithography. The radiation angular distribution for several target materials is investigated and source debris is characterized.

4407 Geophysical and Meteorological Instrumentation

Refer also to citation(s) 24484, 24485, 24489, 24494, 24499, 24501, 24505, 24511, 24519, 24530

24397 (UCRL-ID–120168) **A qualitative study of internal wave ship wakes: Dependence on environmental conditions and experimental parameters.** Mullenhoff, C.J.; Brase, J.M. Lawrence Livermore National Lab., CA (United States). 24 Apr 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015849. Source: OSTI; NTIS; GPO Dep.

For the past several years the UK-US Radar Ocean Imaging Program has conducted a series of field experiments with the primary purpose of gathering real aperture radar (RAR) imagery at low grazing angle of ship-generated internal wave (IW) wakes. The first observations with RAR's were made in the 1989 Loch Linnhe experiment where it was observed that radar images at low grazing angles (LGA) of approximately six degrees had significantly higher modulation levels than SAR images made at higher grazing angles of 35 - 65 degrees. These initial observations have led to several more experiments designed to verify the phenomenon and to test its dependence on experimental and environmental conditions. A parallel effort began to develop theoretical models of the LGA imaging process. Through this series of experiments we have developed an extensive database of radar imagery and supporting environmental data. The objective of this report is twofold: (1) To describe the database and the associated space of parameters. We will look at the coverage of the parameter space within the database and at areas which should be covered. (2) To take an initial look at the dependence of qualitative modulation strength on the experimental and environmental parameters. This first look will indicate the strongest dependencies which can then be studied in more detail. Section 2 describes the experimental database and Section 3 discusses the parameter space, image quality, and their relationships based on the images in the database. In Section 4 we summarize our conclusions and make recommendations for both future analyses and experiments.

4408 Miscellaneous Instrumentation

Refer also to citation(s) 23396, 23400, 24256, 24382, 24385, 24387, 24439, 24450, 24985, 24995

24398 (DOE/CE/15605–T3) **Surface profiling system: Optimized for inspection of turbine blades. Technical progress report No. 3, April 1, 1995–July 21, 1995.** DCS Corp., Alexandria, VA (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-94CE15605. Order Number DE95015543. Source: OSTI; NTIS; GPO Dep.

A system is being designed for the inspection of turbine blades. This report describes progress made with the hardware and software for the system.

24399 Method and apparatus for analyzing eddy-current test measurements. Levy, A.J. 1993. Filed date 10 May 1993. U.S. Patent Application 8-058,850. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC12-76SN00052. Order Number DE95015050. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Eddy-current response voltages, generated during inspection of metallic structures for anomalies, are often replete with noise. Therefore, analysis of the inspection data and results is difficult or near impossible, resulting in inconsistent or unreliable evaluation of the structure. This invention processes the eddy-current response voltage, removing the effect of random noise, to allow proper identification of anomalies within and associated with the structure.

24400 Ion cyclotron resonance cell. Weller, R.R. 1993. Filed date 4 May 1993. U.S. Patent Application 8-064,887. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95015049. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of an ion cyclotron resonance cell having two adjacent sections separated by a center trapping plate. The first section is defined by the center trapping plate, a first end trapping plate, and excitation and detector electrodes. The second section includes a second end trapping plate spaced apart from the center plate, a mirror, and an analyzer. The analyzer includes a wavelength-selective light detector, such as a detector incorporating an acousto-optical device (AOD) and a photodetector. One or more ion guides, grounded plates with holes for the ion beam, are positioned within the vacuum chamber of the mass spectrometer between the ion source and the cell. After ions are trapped and analyzed by ion cyclotron resonance techniques in the first section, the ions of interest are selected according to their mass and passed into the second section for optical spectroscopic studies. The trapped ions are excited by light from a laser and caused thereby to fluoresce. The fluorescent light emitted by the excited ions is reflected by the mirror and directed onto the detector. The AOD is scanned, and the photodetector output is recorded and analyzed. The ions remain in the second section for an extended period, enabling multiple studies to be carried out on the same ensemble of ions.

24401 Monitoring probe for groundwater flow. Looney, B.B.; Ballard, S. 1993. Filed date 25 May 1993. U.S. Patent Application 8-066,236. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95015046. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of a monitoring probe for detecting groundwater migration. The monitor features a cylinder made of a permeable membrane carrying an array of electrical conductivity sensors on its outer surface. The cylinder is filled with a fluid that has a conductivity different than the groundwater. The probe is placed in the ground at an area of interest to be monitored. The fluid, typically saltwater, diffuses through the permeable membrane into the groundwater. The flow of groundwater passing around the permeable membrane walls of the cylinder carries the conductive fluid in the same general direction and distorts the conductivity field measured by the sensors. The degree of distortion from top to bottom and around the probe is precisely related to the vertical and horizontal flow rates, respectively. The electrical conductivities measured by the sensors about the outer surface of the probe are analyzed to determine the rate and direction of the groundwater flow.

24402 (UCRL-ID–119535) **Progress reports for October 1994 – Joint UK/US Radar Program.** Twogood, R.E.; Brase, J.M.; Mantrom, D.D.; Chambers, D.H.; Robey, H.F. Lawrence Livermore National Lab., CA (United States). 18 Nov 1994. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015425. Source: OSTI; NTIS; GPO Dep.

This report gives the principle investigator, objectives, recent accomplishments, milestones for reporting period, expected milestones for ensuing period, other issues and planned expenditures for each of the following programs: airborne RAR/SAR; radar data processor; ground-based SAR signal processing workstation; static airborne radar; multi-aperture space-time array radar; radar field experiments; data analysis and detection theory; management; E-2C radar data analysis; modeling and analysis; current meter array; UCSB wave tank; stratified flow facility; and IR sensor system. Finally the budget status is given.

24403 (UCRL-ID–119535-1) **Progress reports for period November 1–30, 1994 – Joint UK/US Radar Program.** Twogood, R.E.; Brase, J.M.; Mantrom, D.D.; Chambers, D.H.; Robey, H.F. Lawrence Livermore National Lab., CA (United States). 19 Dec 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015426. Source: OSTI; NTIS; GPO Dep.

This report gives the principle investigator, objectives, recent accomplishments, milestones for reporting period, expected milestones for ensuing period, other issues and planned expenditures for the following programs: airborne RAR/SAR; radar data processor; ground-based SAR signal processing workstation; static airborne radar; multi-aperture space-time array radar; radar field experiments; data analysis and detection theory; management; E-2C radar data analysis;modeling and analysis; current meter array; UCSB wave tank; stratified flow facility; and IR sensor system. Budget status is also given.

24404 (UCRL-ID–120260) **Design of a five-axis flux-gate magnetic-gradiometer system Tracking Code No. 93-SR-035.** Hoard, R.W.; Hunter, S. Lawrence Livermore National Lab., CA (United States). 6 Mar 1995. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95016047. Source: OSTI; NTIS; GPO Dep.

Short communication. EARTHQUAKES/detection; MAGNETOMETERS/design; EARTHQUAKES; DETECTION; GROUND MOTION; SEISMIC WAVES; MAGNETOMETERS; DESIGN; COST

24405 (UCRL-JC–118762) **Use of the AIC with the EM algorithm: A demonstration of a probability model selection technique.** Glosup, J.G.; Axelrod, M.C. Lawrence Livermore National Lab., CA (United States). 12 Aug 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9408107–6: American Statistical Association, Toronto (Canada), 14-18 Aug 1994). Order Number DE95014156. Source: OSTI; NTIS; GPO Dep.

The problem of discriminating between two potential probability models, a Gaussian distribution and a mixture of Gaussian distributions, is considered. The focus of interest is a case where the models are potentially non-nested and the parameters of the mixture model are estimated through the EM algorithm. The AIC, which is frequently used as a criterion for discriminating between non-nested models, is modified to work with the EM algorithm and is shown to provide a model selection tool for this situation. A particular problem involving an infinite mixture distribution known as Middleton's Class A model is used to demonstrate the effectiveness and limitations of this method. The problem involves a probability model for underwater noise due to distant shipping.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 23395, 23399, 24941

24406 (ANL/DIS/CP–85699) **Simulation of transportation movements over constrained infrastructure networks.** Macal, C.M.; Van Groningen, C.N.; Braun, M.D. Argonne National Lab., IL (United States). [1995]. 7p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950439–15: SMS simulation multiconference: simulation as a critical technology, Phoenix, AZ (United States), 9-13 Apr 1995). Order Number DE95013676. Source: OSTI; NTIS; GPO Dep.

The Enhanced Logistics Intra-Theater Support Tool (ELIST) is a simulation-based decision support system that evaluates a military deployment plan at the theater level for transportation and logistical feasibility. ELIST includes a discrete-event, time-stepped simulation kernel written in C, an object-oriented database written in Prolog, and a set of knowledge-bases that describe various operations, such as throughput capacity of ports, based on the attributes of the relevant objects. In the course of its development, ELIST has been used to support various planning activities.

24407 (CONF-950232–36) **Robotic conveyance of artillery projectiles for remote ammunition resupply operations.** Ray, T.L.; Glassell, R.L. Oak Ridge National Lab., TN (United States). [1995]. 15p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. American Nuclear Society meeting on robotics and remote systems; Monterey, CA (United States); 5-10 Feb 1995. Order Number DE95014288. Source: OSTI; NTIS; GPO Dep.

The U.S. Army's Project Manager, Advanced Field Artillery System/Future Armored Resupply Vehicle has given Oak Ridge National Laboratory the task of developing a robotic conveyance system which will provide automated artillery ammunition transfer. This technology is currently being developed and will be demonstrated in the summer of 1995. This paper describes the development of an ammunition transfer arm to date. The arm consists of three sections and 6 D.F. which will allow the Future Armored Resupply Vehicle to dock and mate with the Advanced Field Artillery System on terrain varying from $\pm 10°$ in pitch, yaw, and roll and will allow for alignment of the fuel and propellant transfer ports. This arm will deliver the ammunition to the AFAS, where it will be received by an automatic handling and storage system inside the AFAS.

24408 (CONF-9503164–3) **Levelized cost-benefit analysis of proposed diagnostics for the Ammunition Transfer Arm of the US Army's Future Armored Resupply Vehicle.** Wilkinson, V.K.; Young, J.M. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Agreement 1892-A078-A1. From 6. annual tank automotives command (TACOM) combat vehicle survivability symposium; Monterey, CA (United States); 28-30 Mar 1995. Order Number DE95013972. Source: OSTI; NTIS; GPO Dep.

The US Army's Project Manager, Advanced Field Artillery System/Future Armored Resupply Vehicle (PM-AFAS/FARV) is sponsoring the development of technologies that can be applied to the resupply vehicle for the Advanced Field Artillery System. The Engineering Technology Division of the Oak Ridge National Laboratory has proposed adding diagnostics/prognostics systems to four components of the Ammunition Transfer Arm of this vehicle, and a cost-benefit analysis was performed on the diagnostics/prognostics to show the potential savings that may be gained by incorporating these systems onto the vehicle. Possible savings could be in the form of reduced downtime, less unexpected or unnecessary maintenance, fewer regular maintenance checks. and/or tower collateral damage or loss. The diagnostics/prognostics systems are used to (1) help determine component problems, (2) determine the condition of the components, and (3) estimate the remaining life of the monitored components. The four components on the arm that are targeted for diagnostics/prognostics are (1) the electromechanical brakes, (2) the linear actuators, (3) the wheel/roller bearings, and (4) the conveyor drive system. These would be monitored using electrical signature analysis, vibration analysis, or a combination of both. Annual failure rates for the four components were obtained along with specifications for vehicle costs, crews, number of missions, etc. Accident scenarios based on component failures were postulated, and event trees for these scenarios were constructed to estimate the annual loss of the resupply vehicle, crew, arm. or mission aborts. A levelized cost-benefit analysis was then performed to examine the costs of such failures, both with and without some level of failure reduction due to the diagnostics/prognostics systems. Any savings resulting from using diagnostics/prognostics were calculated.

24409 (CONF-9503168–1) **Defining the next generation munitions handler.** Cassiday, B.K. (San Antonio Air Logistics Center, Kelly AFB, TX (United States)); Koury, G.J.; Pin, F.G. Oak Ridge National Lab., TN (United States). [1995]. 6p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Agreement 2146-H055-A1. From 10. American Institute of Aeronautics and Astronautics (AIAA) conference on computing and aerospae; San Antonio, TX (United States); 28-30 Mar 1995. Order Number DE95013970. Source: OSTI; NTIS; GPO Dep.

RHIC 8 cm aperture dipole magnets and quadrupole cold masses are being built for Brookhaven National Laboratory (BNL) by Northrop-Grumman Corporation at a production rate of one dipole magnet and two quadrupole cold masses per day. This work was preceded by a lengthy Technology Transfer effort which is described elsewhere. This paper describes the tooling which is being used for the construction effort, the production operations at each workstation, and also the use of trend plots of critical construction parameters as a tool for monitoring performance in production. A

report on the improvements to production labor since the start of the programs is also provided. The magnet and cold mass designs, and magnetic test results are described in more detail in a separate paper.

24410 (SAND–94-2875) **Evaluation of commercially available exterior digital VMDs.** Ringler, C.E.; Hoover, C.E. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 120p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014129. Source: OSTI; NTIS; GPO Dep.

This report discusses the testing and evaluation of thirteen commercially available exterior digital video motion detection (VMD) systems. The systems were evaluated for use in a specific outdoor application. The report focuses primarily on the testing parameters, each system's advertised features, and the nuisance alarm and detection test results.

24411 (UCRL-JC–117608) **Molten salt destruction of energetic material wastes as an alternative to open burning.** Upadhye, R.S.; Brummond, W.A.; Pruneda, C.O.; Watkins, B.E. Lawrence Livermore National Lab., CA (United States). 8 Sep 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409352–1: United States/German data exchange agreement (DEA-1522) meeting, No City Given (Germany), 27-30 Sep 1994). Order Number DE95013452. Source: OSTI; NTIS; GPO Dep.

The Lawrence Livermore National Laboratory in conjunction with the Energetic Materials Center (a partnership of Lawrence Livermore and Sandia National Laboratories), is developing methods for the safe and environmentally sound destruction of explosives and propellants as a part of the Laboratory's ancillary demilitarization mission. As a result of the end of the Cold War and the shift in emphasis to a smaller stockpile, many munitions, both conventional and nuclear, are scheduled for retirement and rapid dismantlement and demilitarization. major components of these munitions are the explosives and propellants, or energetic materials. The Department of Energy has thousands of pounds of energetic materials which result from dismantlement operations at the Pantex Plant. The Department of Defense has several hundred million pounds of energetic materials in its demilitarization inventory, with millions more added each year.

24412 (WR-B–95-06) **Audit of construction of protective force training facilities at the Pantex Plant.** USDOE Office of Inspector General, Albuquerque, NM (United States). Western Regional Audit Office. 5 May 1995. 22p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI.

A goal of the Department of Energy project management system is to ensure that projects are necessary to fulfill mission needs and are cost effective. This requires that the Department justify each project and explore competitive alternatives. The objective of this audit was to assess the need to construct protective force training facilities at the Department's Pantex Plant. Our audit disclosed that (1) construction of a physical training facility was not necessary to fulfill mission needs, and (2) the Department did not consider all viable alternatives to constructing a weapons tactics and training facility. These conditions occurred, in part, because a Justification for New Start was never prepared and approved for the Security Enhancements Major System Acquisition, which included these two projects. We recommended that the Manager, Albuquerque Operations Office, cancel construction of the physical training facility, make needed repairs and upgrades to the existing facilities, and reduce the cost of the Security Enhancements Major System Acquisition accordingly. Implementation of this recommendation will save about $1.7 million. We also recommended that the Manager direct Mason & Hanger to perform economic analyses of all viable alternatives to constructing a weapons tactics and training facility before proceeding with construction. Such analyses could lead to cancellation or rescoping of the proposed facility and result in savings to the Department. Albuquerque management did not agree to cancel construction of the physical training facility, but did agree to perform economic analyses of all viable alternatives to the proposed weapons tactics and training facility before proceeding with construction.

4501 Chemical Explosions and Explosives

Refer also to citation(s) 24558, 25012

24413 (DOE/AL/65030–9421) **Treatment and recycle of high explosive contaminated water.** Locke, J.G. Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (United States). Sep 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL65030. Order Number DE95013542. Source: OSTI; NTIS; GPO Dep.

A polysulfone ultrafilter membrane having a 0.04-μm pore opening has been used to filter high explosive contaminated water. The water is being recycled for the coolant used during the machining of high explosive billets. High explosive contaminated wastewater is generated from the machining of high explosives at Pantex Plant. The water is used as the coolant during the machining operation. Typically, the water flow rate is from 2 to 3 gallons per minute. The water must be tempered to about room temperature so that it does not affect the dimensions of the explosive piece being machined. In normal operations, the wastewater and cuttings are allowed to flow to a centralized collection system. The solid explosives are separated from the water using a filtration and recycle system. The wastewater is collected in an air agitated receiving tank or sump. It is pumped from the sump to a settling cone where the solid particles are decanted off of the bottom. The overflow from the cone is collected in another tank and then pumped through two cyclone separators operated in series. This water is also collected in a holding tank prior to final filtration through a 25-μm filter. The effluent from the particle filter flows through two activated carbon filters operated in series prior to being discharged to a drainage ditch. This results in an average discharge of about 2,000 gallons per operating day from Building 11-50.

24414 (DOE/AL/65030–9505) **Size reduction of hemispherical explosive shells by waterjet.** Crutchmer, J.A.; Do, B.T.; Goodfellow, P.A. Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (United States). Feb 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL65030. Order Number DE95013543. Source: OSTI; NTIS; GPO Dep.

A water jet process has been developed to reduce hemispherical explosive shells to a form that can be recycled. A funnel shaped wet box was modified to hold the shells in place and contain all the explosive chips and slurry generated by the waterjet process. Size reduction was accomplished by cutting in spiral patterns starting at the center of the shell and moving outward. This method of size reduction produces less than one third the amount of waste water and requires less than one half the time to complete compared to conventional machining methods.

24415 (LA–13014-H) **The insensitive high explosive triaminotrinitrobenzene (TATB): Development and characterization, 1888 to 1994.** Dobratz, B.M. Los Alamos National Lab., NM (United States). Aug 1995. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95016705. Source: OSTI; NTIS; GPO Dep.

Assembled in this report are data and references on TATB and its formulations from its first synthesis in 1888 to 1994. This compilation includes sections on synthesis and preparation, analytical methods, properties, performance, aging and compatibility, and on safety. The information is arranged in chronological order within each section. A bibliography rounds out the report.

24416 (SAND–95-0968C) **An overview of semiconductor bridge, SCB, applications at Sandia National Laboratories.** Bickes, R.W. Jr.; Grubelich, M.C.; Harris, S.M.; Merson, J.A.; Weinlein, J.H. Sandia National Labs., Albuquerque, NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950720–5: AIAA/SAE/ASME joint propulsion conference and exhibit, San Diego, CA (United States), 10-12 Jul 1995). Order Number DE95011877. Source: OSTI; NTIS; GPO Dep.

The semiconductor bridge, SCB, developed by Sandia National Laboratories is a maturing technology now being used in several applications by Sandia customers. Most applications arose because of a need at the system level to provide explosive assemblies that were light weight, small volume, low cost and required

small quantities of electrical energy to function – for the purposes of this paper we define an explosive assembly to mean the combination of the firing set and an explosive component. As a result, and because conventional firing systems could not meet the stringent size, weight and energy requirements of our customers, we designed and are investigating SCB applications that range from devices for Sandia applications to igniters for fireworks. We present in this paper an overview of SCB technology with specific examples of the system designed for our customers to meet modern requirements that sophisticated explosive systems must satisfy in today's market environments.

24417 (SAND–95-8227) **Particle size reduction of propellants by cryocycling.** Whinnery, L. (and others); Griffiths, S.; Lipkin, J. Sandia National Labs., Livermore, CA (United States). May 1995. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015266. Source: OSTI; NTIS; GPO Dep.

Repeated exposure of a propellant to liquid nitrogen causes thermal stress gradients within the material resulting in cracking and particle size reduction. This process is termed cryocycling. The authors conducted a feasibility study, combining experiments on both inert and live propellants with three modeling approaches. These models provided optimized cycle times, predicted ultimate particle size, and allowed crack behavior to be explored. Process safety evaluations conducted separately indicated that cryocycling does not increase the sensitivity of the propellants examined. The results of this study suggest that cryocycling is a promising technology for the demilitarization of tactical rocket motors.

24418 (SAND–95-8235) **Cryocycling of energetic materials: Status report for FY94.** Lipkin, J. (ed.); Kasberg, D.; Whinnery, L.; Handrock, J.; Revelli, V.; Weingarten, L.; Griffiths, S.; Nilson, R. Sandia National Labs., Livermore, CA (United States). Jul 1995. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015268. Source: OSTI; NTIS; GPO Dep.

The Cryocycling of Energetic Materials Project is sponsored by the Memorandum of Understanding (MOU) on advanced munition technologies. This MOU is an agreement between the Department of Energy and the Department of Defense (Office of Munitions) that facilitates the development of technologies of mutual interest to the two Departments. The cryocycling project is one of several that focus on demilitarization aspects of conventional weapons and weapon systems. During FY94 the project pursued the development of analytical and numerical models that can be used to describe and optimize the cryocycling process for preparing energetic materials for recycle and reuse. In addition, the demilitarization stockpile of the Department of Defense was analyzed to identify candidate munitions for the process, and pilot scale cryocycling operations were begun at an industrial contractor. When a material is cryocycled, it is repeatedly subjected to cycles of rapid cooling in a liquid nitrogen bath at 77 K followed by warming to ambient temperature. In laboratory and pilot scale demonstrations, the authors have shown that cryocycling can dramatically reduce the size of a variety of propellant grains and a number of cast and plastic bonded explosives.

24419 (SAND–95-8248) **Investigations of emergency destruction methods for recovered, explosively configured, chemical warfare munitions: Interim emergency destruction methods - evaluation report.** Baer, M.R. (and others); Cooper, P.W.; Kipp, M.E. Sandia National Labs., Albuquerque, NM (United States). Jul 1995. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015840. Source: OSTI; NTIS; GPO Dep.

At the request of the U.S. Army Non-Stockpile Chemical Material Office, the Sandia Explosives Containment System Design Team investigated mature destruction systems for destroying recovered chemical warfare munitions (CWM). The goal of the investigations was to identify and examine available techniques for the destruction of recovered CWM. The result of this study is a recommendation for an interim solution, a solution for use on any munitions found while an optimal, long-term solution is developed. Sandia is also performing the long-term solution study to develop a system that destroys CWM, contains the blast and fragments, and destroys the chemical agent without insult to the environment.

24420 (UCRL-ID–119252) **The shock Hugoniot of glass microballoons.** Simpson, R.; Helm, F. Lawrence Livermore National Lab., CA (United States). Dec 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015846. Source: OSTI; NTIS; GPO Dep.

Shock Hugoniot measurements were made on glass microballoons. Input pressures ranging from 0.37-3.9 GPa produced compression from 860-690%. The Hugoniot curves were found to be anomalous in that the density shocked to decreases with increasing pressure.

24421 (UCRL-ID–119675) **A new insensitive explosive that has moderate performance and is low cost: 2,4-Dinitroimidazole.** Simpson, R. (and others); Coon, C.; Foltz, M. Lawrence Livermore National Lab., CA (United States). Jan 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015973. Source: OSTI; NTIS; GPO Dep.

Shock loading experiments were performed on 2,4-Dinitroimidazole. Results indicate that it is a very shock insensitive material. The performance of the material is expected to be 60% greater than TNT. Costs appear to be low but are unresolved at this time. 2,4-DNI may be a realistic alternative to TNT for mass-use bombs.

24422 (UCRL-JC–117608-Rev.1) **Molten salt destruction of energetic material wastes as an alternative to open burning. Revision 1.** Upadhye, R.S. (Lawrence Livermore National Lab., CA (United States). Energetic Materials Center); Brummond, W.A.; Pruneda, C.O.; Watkins, B.E. Lawrence Livermore National Lab., CA (United States). 2 Nov 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9411155–4-Rev.1: 1994 Luxembourg international symposium on the rehabilitation of military sites and demilitarization of explosive ordance, Kirchberg (Luxembourg), 14-18 Nov 1994). Order Number DE95013461. Source: OSTI; NTIS; GPO Dep.

As a result of the end of the Cold War and the shift in emphasis to a smaller stockpile, many munitions, both conventional and nuclear, are scheduled for retirement and rapid dismantlement and demilitarization. Major components of these munitions are the explosives and propellants, or energetic materials. The Molten Salt Destruction (MSD) Process has been demonstrated for the destruction of HE and HE-containing wastes. MSD converts the organic constituents of the waste into non-hazardous substances such as carbon dioxide, nitrogen and water. Any inorganic constituents of the waste, such as binders and metallic particles, are retained in the molten salt. LLNL has built a small-scale (about 1 kg/hr throughput) unit to test the destruction of HE using the MSD process. The authors have demonstrated that HE's and liquid propellants can be safely and fully destroyed using the molten salt destruction process. The authors are currently working on a number of improvements to the process. They are modifying the design of unit to obtain more throughput without any increase in salt entrainment. They are implementing an advanced nozzle design for injection of larger particles. They are defining operating envelopes for a number of high explosives and formulations. They are developing models to study the temperature profile of a top-feed nozzle for feeding larger particles into the unit.

24423 (UCRL-JC–117609) **Reusing main-charge explosives from the demilitarization of weapons.** Pruneda, C.O.; Mitchell, A.R. Lawrence Livermore National Lab., CA (United States). Aug 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409352–2: United States/German data exchange agreement (DEA-1522) meeting, No City Given (Germany), 27-30 Sep 1994). Order Number DE95013460. Source: OSTI; NTIS; GPO Dep.

We are formulating improved methods for reusing dismantled nuclear weapons. We are emphasizing the commercial value of these explosives and are working toward establishing processing protocols to ease the transition from dismantlement to commercial use. These applications on explosives removed from conventional ordnance or strategic materials from strategic/tactical rocket motors.

Discussed issues include: alternatives to burning, size reduction, reformulation, explosive powder recovery, chemical conversion, and legal matters.

24424 (UCRL-JC–117609-Rev.1) **Reusing main-charge explosives from the demilitarization of weapons. Revision 1.** Pruneda, C.O.; Mitchell, A.R. Lawrence Livermore National Lab., CA (United States). 1 Dec 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9411155–5-Rev.1: 1994 Luxembourg international symposium on the rehabilitation of military sites and demilitarization of explosive ordance, Kirchberg (Luxembourg), 14-18 Nov 1994). Order Number DE95013453. Source: OSTI; NTIS; GPO Dep.

We are formulating improved methods for re-using dismantled nuclear weapons. We are emphasizing the commercial value of these explosives and are working toward establishing processing protocols to ease the transition from dismantlement to commercial use. These processes can have applications on explosives removed from conventional ordnance or energetic materials removed strategic/tactical rocket motors. Issues discussed in this report include: alternatives to burning, size reduction, reformulation, explosive powder recovery, chemical conversion, and legal issues.

24425 (UCRL-JC–119654) **Advances in the chemical conversion of energetic materials to higher value products.** Mitchell, A.R. (Lawrence Livermore National Lab., CA (United States). Energetic Materials Center); Pagoria, P.F.; Sanner, R.D. Lawrence Livermore National Lab., CA (United States). 24 Jan 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941255–4: Life cycles of energetic materials, Del Mar, CA (United States), 11-16 Dec 1994). Order Number DE95013458. Source: OSTI; NTIS; GPO Dep.

The objective of this program is to develop novel, innovative solutions for the disposal of surplus explosives resulting from the demilitarization of nuclear and conventional munitions by DOE and DoD. Studies related to the conversion of TNT and Explosive D to potentially useful materials are described. The paper describes the feasibility of conversion of TNT to TATB; conversion of TNT to 3,5-diamino-2,4,6-trinitrotoluene (DATNT); conversion of TNT to tolylene 2,4-diisocyanate (TDI) and nitrotolylene and diisocyanate (NTDI); chelating resins derived from trinitroarenes.

4502 Nuclear Explosions and Explosives

Refer also to citation(s) 23382, 23386, 23403, 23669, 23827, 24423, 24424, 24614, 24910, 25012

24426 (DOE/EIS–0228D) **Dual Axis Radiographic Hydrodynamic Test Facility: Draft environmental impact statement.** USDOE Albuquerque Operations Office, NM (United States). May 1995. 468p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95012204. Source: OSTI; NTIS; GPO Dep.

DOE proposes to provide enhanced high-resolution radiographic capability for hydrodynamic tests and dynamic experiments to meet its mission to conduct a science-based stockpile stewardship program for the Nation's nuclear weapons. The DARHT Facility would include two electron accelerators to produce x-ray beams that intersect at a firing point. This document evaluates the potential environmental impacts of six alternatives: No Action (continue to operate the 30-year-old Pulsed High Energy Radiation Machine Emitting X-Rays (PHERMEX) at Los Alamos National Laboratories (LANL) and the Flash X-Ray at Lawrence Livermore National Laboratory); Preferred Alternative (complete and operate the DARHT Facility at LANL); Upgrade PBERMEX (upgrade PHERMEX with enhanced radiography technology instead of completing the DARHT Facility); Enhanced Containment (in addition to containing all experiments involving plutonium, enclose most or all experiments inside a containment vessel or structure); Plutonium Exclusion (exclude any applications involving experiments with plutonium at the DARHT Facility); and Single-Axis (complete and operate only a single axis of the DARHT Facility). The affected environment is primarily within LANL. Analyses indicate very little difference in the environmental impacts among the alternatives. The major discriminator would be contamination of soils near the firing points, health effects to workers, and amount of construction materials.

24427 (DOE/IG–0375) **US Department of Energy Office of Inspector General report on audit of the Department of Energy's management of precious metals.** USDOE Office of Inspector General, Washington, DC (United States). Jun 1995. 20p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The US Department of Energy (Department) used precious metals primarily in the production of nuclear weapons. In accordance with Strategic Arms Reduction Treaties, the Department stopped producing nuclear weapons and much of its precious metals inventory became excess to programmatic need. The purpose of the audit was to determine if the Department and contractor officials were efficiently and effectively administering this valuable asset. The authors found that 6 of 11 Departmental organizations were not adequately identifying and disposing of excess precious metals. At the time of the audit, the Department had approximately $52 million worth of precious metals inventory on hand. Included in this inventory was about $10.3 million that was considered excess. In addition, the Department has the opportunity to recover precious metals worth about $36 million from disassembled nuclear weapons that will also be excess to programmatic need. Although substantial quantities of excess precious metals existed, property management officials had not developed effective procedures to dispose of excess metals through other Government agencies or on the open market. The term precious metals is defined in the property management regulations as uncommon and highly valuable metals characterized by their superior resistance to corrosion and oxidation. Eight metals fall under this definition: gold, silver, platinum, palladium, rhodium, iridium, ruthenium, and osmium.

24428 (DOE/NV–383) **United States Department of Energy, Nevada Operations Office completion report: Fiscal year 1994.** USDOE Nevada Operations Office, Las Vegas, NV (United States). Jun 1995. 216p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014358. Source: OSTI; NTIS; GPO Dep.

The report provides a summary of activities conducted at the Nevada Test Site (NTS) between October 1, 1993, and September 30, 1994. In the past, each annual Completion Report dealt with a series of underground nuclear detonations; however, because no nuclear tests were conducted during fiscal year (FY) 1994, this report summarizes continuing nonnuclear and nuclear test readiness activities at the NTS. Sections describe the following: planning and review; test execution; operations coordination; safeguards and security; operations costs and manpower; external affairs; verification management; emergency response management; meteorological support; radiological safety; safety; environmental protection; geological and geophysical investigations; hydrologic investigations; seismic motion records repository; radioecologic investigations; cultural resources investigations; instrumentation and energy measurements services; architectural and engineering services; construction and support services; and Department of Defense activities.

24429 (KCP–613-5430) **Design specifications for manufacturability of MCM-C multichip modules.** Allen, C.; Blazek, R.; Desch, J.; Elarton, J.; Kautz, D.; Markley, D.; Morgenstern, H.; Stewart, R.; Warner, L. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Jun 1995. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE95014898. Source: OSTI; NTIS; GPO Dep.

The scope of this document is to establish design guidelines for electronic circuitry packaged as multichip modules of the ceramic substrate variety, although many of these guidelines are applicable to other types of multichip modules. The guidelines begin with prerequisite information which must be developed between customer and designer of the multichip module. The core of the guidelines focuses on the many considerations that must be addressed during the multichip module design. The guidelines conclude with the resulting deliverables from the design which satisfy customer requirements and/or support the multichip module fabrication and

testing processes. Considerable supporting information, checklists, and design constraints are captured in specific appendices and used as reference information in the main body text. Finally some real examples of multichip module design are presented.

24430 (KCP–613-5536) **CFC and CHC reduction at suppliers. Final report.** Carter, R.C. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Jul 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE95014897. Source: OSTI; NTIS; GPO Dep.

Alternative cleaning methods and materials were required to reduce the use of ozone-depleting solvents or potentially hazardous materials (chlorofluorocarbons and chlorinated hydrocarbons) at purchased product suppliers. Three groups of printed wiring boards were fabricated by Sparton Technology Inc., the vendor selected to complete the project. These printed wiring boards were evaluated in the Materials Engineering laboratory at the Kansas City Division. Recommendations included using a rosin-based flux and an enhanced cleaning process with Bioact EC-7R as the preferred solvent. Results of the study were included in the Solvent Waste Stream database.

24431 (SAND–94-2814C) **Computer modeling of electrical performance of detonators.** Furnberg, C.M. (Sandia National Labs., Livermore, CA (United States)); Peevy, G.R.; Brigham, W.P.; Lyons, G.R. Sandia National Labs., Albuquerque, NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950720–6: AIAA/SAE/ASME joint propulsion conference and exhibit, San Diego, CA (United States), 10-12 Jul 1995). Order Number DE95011878. Source: OSTI; NTIS; GPO Dep.

An empirical model of detonator electrical performance which describes the resistance of the exploding bridgewire (EBW) or exploding foil initiator (EFI or slapper) as a function of energy, deposition will be described. This model features many parameters that can be adjusted to obtain a close fit to experimental data. This has been demonstrated using recent experimental data taken with the cable discharge system located at Sandia National Laboratories. This paper will be a continuation of the paper entitled "Cable Discharge System for Fundamental Detonator Studies" presented at the 2nd NASA/DOD/DOE Pyrotechnic Workshop.

24432 (SAND–95-1364C) **Application of optimization to the inverse problem of finding the worst-case heating configuration in a fire.** Romero, V.J.; Eldred, M.S.; Bohnhoff, W.J.; Outka, D.E. Sandia National Labs., Albuquerque, NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950715–1: 9. international conference on numerical methods in laminar and turbulent flow, Atlanta, GA (United States), 10-14 Jul 1995). Order Number DE95014861. Source: OSTI; NTIS; GPO Dep.

Thermal optimization procedures have been applied to determine the worst-case heating boundary conditions that a safety device can be credibly subjected to. There are many interesting aspects of this work in the areas of thermal transport, optimization, discrete modeling, and computing. The forward problem involves transient simulations with a nonlinear 3-D finite element model solving a coupled conduction/radiation problem. Coupling to the optimizer requires that boundary conditions in the thermal model be parameterized in terms of the optimization variables. The optimization is carried out over a diverse multi-dimensional parameter space where the forward evaluations are computationally expensive and of unknown duration a priori. The optimization problem is complicated by numerical artifacts resulting from discrete approximation and finite computer precision, as well as theoretical difficulties associated with navigating to a global minimum on a nonconvex objective function having a fold and several local minima. In this paper we report on the solution of the optimization problem, discuss implications of some of the features of this problem on selection of a suitable and efficient optimization algorithm, and share lessons learned, fixes implemented, and research issues identified along the way.

4503 Nuclear Explosion Detection

Refer also to citation(s) 23830

24433 (UCRL-ID–121036) **Pre-shot predictions and instrumentation of the KUCHEN experiment.** Moran, B.; Heinle, R.A.; Harben, P.E. Lawrence Livermore National Lab., CA (United States). May 1995. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014514. Source: OSTI; NTIS; GPO Dep.

We calculated the peak particle velocity and peak acceleration at gage locations for the three explosions of the KUCHEN experiment. Our predictions of the peak particle velocities and accelerations are consistent with a variety of other estimates which include surface motion obtained from underground nuclear explosions in alluvium, a tamped HE explosion at the Nevada Test Site, and the ConWep estimates which are used for conventional weapons effects calculations. We also predict the air blast overpressure and the temperature rise in the air inside the cavity of the decoupled explosion and find that the peak pressure at the top of the cylindrical cavity is about 50 bars and that the shock-wave reverberations inside the cavity have a period of about 100 ms. After 500 ms, the shock wave reverberations inside the cavity of the decoupled explosion are considerably attenuated and the equilibrium state before any significant diffusion or thermal conduction occurs is a pressure of 5 bars and a temperature of 1100°C. The instrumentation of the experiment is designed for containment diagnostics, near-field in-situ motion, and ground motion monitoring. The containment diagnostics include an air-blast overpressure gage, an RF Interferometer, a strain gage, two thermocouples and two cavity pressure gages. Additional gages detect the presence of hazardous detonation products. Near field motion diagnostics include four three-axis accelerometers at various depths and a single three-axis velocity gage. The seismic ground motion sensors are located in 24 distinct locations and distributed in a modified symmetrical pattern around the borehole. Using a simple constitutive model which correctly predicts peak particle velocity data in porous alluvium, we calculated a decoupling factor that varies from 4 to 11 in the frequency range between 1 and 30 hertz. Using that same model, we calculated a decoupling factor of 15 in a spherical cavity with equivalent volume.

24434 (UCRL-ID–121228) **Preliminary report on the implications of mining practices in an open-pit gold mine for monitoring of a comprehensive Test Ban Treaty.** Jarpe, S.P.; Goldstein, P.; Moran, B.; Glenn, L.A. Lawrence Livermore National Lab., CA (United States). Jul 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015985. Source: OSTI; NTIS; GPO Dep.

This report summarizes the preliminary results of an ongoing experiment at the Gold Quarry pit, operated by the Newmont Gold Company at Carlin, NV. The purpose of the experiment is to obtain local and regional seismic data together with "ground truth", from conventional surface blasting activity and to use these data to help determine the effectiveness with which conventional mining blasts can be discriminated from underground nuclear explosions.

4505 Strategic Defense Initiative

24435 (SAND–95-0798) **Measures of effectiveness for BMD mid-course tracking on MIMD massively parallel computers.** VanDyke, J.P.; Tomkins, J.L.; Furnish, M.D. Sandia National Labs., Albuquerque, NM (United States). May 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95013035. Source: OSTI; NTIS; GPO Dep.

The TRC code, a mid-course tracking code for ballistic missiles, has previously been implemented on a 1024-processor MIMD (Multiple Instruction – Multiple Data) massively parallel computer. Measures of Effectiveness (MOE) for this algorithm have been developed for this computing environment. The MOE code is run in parallel with the TRC code. Particularly useful MOEs include the number of missed objects (real objects for which the TRC algorithm did not construct a track); of ghost tracks (tracks not corresponding to a real object); of redundant tracks (multiple tracks corresponding

to a single real object); and of unresolved objects (multiple objects corresponding to a single track). All of these are expressed as a function of time, and tend to maximize during the time in which real objects are spawned (multiple reentry vehicles per post-boost vehicle). As well, it is possible to measure the track-truth separation as a function of time. A set of calculations is presented illustrating these MOEs as a function of time for a case with 99 post-boost vehicles, each of which spawns 9 reentry vehicles.

24436 (UCRL-JC–120857) **The Clementine longwave infrared camera.** Priest, R.E. (Lawrence Livermore National Lab., CA (United States)); Lewis, I.T.; Sewall, N.R.; Park, H.S.; Shannon, M.J.; Ledebuhr, A.G.; Pleasance, L.D.; Massie, M.A.; Metschuleit, K. Lawrence Livermore National Lab., CA (United States). Apr 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950472–15: SPIE international symposium on aerospace/defense sensing and dual-use photonics, Orlando, FL (United States), 17-21 Apr 1995). Order Number DE95014387. Source: OSTI; NTIS; GPO Dep.

The Clementine mission provided the first ever complete, systematic surface mapping of the moon from the ultra-violet to the near-infrared regions. More than 1.7 million images of the moon, earth and space were returned from this mission. The longwave-infrared (LWIR) camera supplemented the UV/Visible and near-infrared mapping cameras providing limited strip coverage of the moon, giving insight to the thermal properties of the soils. This camera provided ~100 m spatial resolution at 400 km periselene, and a 7 km across-track swath. This 2.1 kg camera using a 128 x 128 Mercury-Cadmium-Telluride (MCT) FPA viewed thermal emission of the lunar surface and lunar horizon in the 8.0 to 9.5 μm wavelength region. A description of this light-weight, low power LWIR camera along with a summary of lessons learned is presented. Design goals and preliminary on-orbit performance estimates are addressed in terms of meeting the mission's primary objective for flight qualifying the sensors for future Department of Defense flights.

24437 (UCRL-JC–120858) **Near-infrared camera for the Clementine mission.** Priest, R.E. (Lawrence Livermore National Lab., CA (United States)); Lewis, I.T.; Sewall, N.R.; Park, H.S.; Shannon, M.J.; Ledebuhr, A.G.; Pleasance, L.D.; Massie, M.A.; Metschuleit, K. Lawrence Livermore National Lab., CA (United States). Apr 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950472–11: SPIE international symposium on aerospace/defense sensing and dual-use photonics, Orlando, FL (United States), 17-21 Apr 1995). Order Number DE95014385. Source: OSTI; NTIS; GPO Dep.

The Clementine mission provided the first ever complete, systematic surface mapping of the moon from the ultra-violet to the near-infrared regions. More than 1.7 million images of the moon, earth and space were returned from this mission. The near-infrared (NIR) multi-spectral camera, one of two workhorse lunar mapping cameras (the other being the UV/visible camera), provided ~200 in spatial resolution at 400 km periselene, and a 39 km across-track swath. This 1.9 kg infrared camera using a 256 x 256 InSb FPA viewed reflected solar illumination from the lunar surface and lunar horizon in the 1 to 3 μm wavelength region, extending lunar imagery and mineralogy studies into the near infrared. A description of this light-weight, low power NIR camera along with a summary of lessons learned is presented. Design goals and preliminary on-orbit performance estimates are addressed in terms of meeting the mission's primary objective for flight qualifying the sensors for future Department of Defense flights.

24438 (UCRL-JC–120866) **UV/visible camera for the Clementine mission.** Kordas, J.F. (and others); Lewis, I.T.; Priest, R.E. Lawrence Livermore National Lab., CA (United States). Apr 1995. 14p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950472–10: SPIE international symposium on aerospace/defense sensing and dual-use photonics, Orlando, FL (United States), 17-21 Apr 1995). Order Number DE95014386. Source: OSTI; NTIS; GPO Dep.

This article describes the Clementine UV/Visible (UV/Vis) multispectral camera, discusses design goals and preliminary estimates of on-orbit performance, and summarizes lessons learned in building and using the sensor. While the primary objective of the Clementine Program was to qualify a suite of 6 light-weight, low power imagers for future Department of Defense flights, the mission also has provided the first systematic mapping of the complete lunar surface in the visible and near-infrared spectral regions. The 410 g, 4.65 W UV/Vis camera uses a 384 x 288 frame-transfer silicon CCD FPA and operates at 6 user-selectable wavelength bands between 0.4 and 1.1 μm. It has yielded lunar imagery and mineralogy data with up to 120 in spatial resolution (band dependent) at 400 km periselene along a 39 km cross-track swath.

24439 (UCRL-JC–120867) **Star tracker stellar compass for the Clementine mission.** Kordas, J.F. (and others); Lewis, I.T.; Wilson, B.A. Lawrence Livermore National Lab., CA (United States). Apr 1995. 14p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950472–9: SPIE international symposium on aerospace/defense sensing and dual-use photonics, Orlando, FL (United States), 17-21 Apr 1995). Order Number DE95014384. Source: OSTI; NTIS; GPO Dep.

The Clementine mission provided the first ever complete, systematic surface mapping of the moon from the ultra-violet to the near-infrared regions. More than 1.7 million images of the moon, earth and space were returned from this mission. Two star tracker stellar compasses (star tracker camera + stellar compass software) were included on the spacecraft, serving a primary function of providing angle updates to the guidance and navigation system. These cameras served a secondary function by providing a wide field of view imaging capability for lunar horizon glow and other dark-side imaging data. This 290 g camera using a 576 x 384 FPA and a 17 mm entrance pupil, detected and centroided stars as dim and dimmer than 4.5 m_V, providing rms pointing accuracy of better than 100 μrad pitch and yaw and 450 μrad roll. A description of this light-weight, low power star tracker camera along with a summary of lessons learned is presented. Design goals and preliminary on-orbit performance estimates are addressed in terms of meeting the mission's primary objective for flight qualifying the sensors for future Department of Defense flights.

24440 (UCRL-JC–120870) **HiRes camera and LIDAR ranging system for the Clementine mission.** Ledebuhr, A.G. (and others); Kordas, J.F.; Lewis, I.T. Lawrence Livermore National Lab., CA (United States). Apr 1995. 20p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950472–14: SPIE international symposium on aerospace/defense sensing and dual-use photonics, Orlando, FL (United States), 17-21 Apr 1995). Order Number DE95014396. Source: OSTI; NTIS; GPO Dep.

Lawrence Livermore National Laboratory developed a space-qualified High Resolution (HiRes) imaging LIDAR (Light Detection And Ranging) system for use on the DoD Clementine mission. The Clementine mission provided more than 1.7 million images of the moon, earth, and stars, including the first ever complete systematic surface mapping of the moon from the ultra-violet to near-infrared spectral regions. This article describes the Clementine HiRes/LIDAR system, discusses design goals and preliminary estimates of on-orbit performance, and summarizes lessons learned in building and using the sensor. The LIDAR receiver system consists of a High Resolution (HiRes) imaging channel which incorporates an intensified multi-spectral visible camera combined with a Laser ranging channel which uses an avalanche photo-diode for laser pulse detection and timing. The receiver was bore sighted to a light-weight McDonnell-Douglas diode-pumped ND:YAG laser transmitter that emmitted 1.06 μm wavelength pulses of 200 mJ/pulse and 10 ns pulse-width, The LIDAR receiver uses a common F/9.5 Cassegrain telescope assembly. The optical path of the telescope is split using a color-separating beamsplitter. The imaging channel incorporates a filter wheel assembly which spectrally selects the light which is imaged onto a custom 12 mm gated image intensifier fiber-optically-coupled into a 384 x 276 pixel frame transfer CCD FPA. The image intensifier was spectrally sensitive over the 0.4 to 0.8 μm wavelength region. The six-position filter wheel contained 4 narrow spectral filters, one broadband and one blocking filter. At

periselene (400 km) the HiRes/LIDAR imaged a 2.8 km swath width at 20-meter resolution. The LIDAR function detected differential signal return with a 40-meter range accuracy, with a maximum range capability of 640 km, limited by the bit counter in the range return counting clock.

4506 Chemical and Biological

Refer also to citation(s) 24419

24441 (ANL/DIS/CP–84688) **Technical basis for chemical stockpile emergency planning.** Newsom, D.E. (Argonne National Lab., IL (United States). Decision and Information Sciences Div.); Madore, M.A.; Paddock, R.A.; Absil, M.J.G. Argonne National Lab., IL (United States). [1995]. 7p. Sponsored by Department of Defense, Washington, DC (United States);USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9505224–1: International Emergency Management and Engineering Society, Nice (France), 9-12 May 1995). Order Number DE95013420. Source: OSTI; NTIS; GPO Dep.

As part of the Chemical Stockpile Emergency Preparedness Program, an Accident Planning Base Review Group (APBRG) was convened in December 1992. The APBRG's mission was to update the accident basis for protective action strategy planning in the vicinity of eight US chemical agent stockpile sites. The results of the APBRG's work are being issued as site-specific Emergency Planning Guides (EPGs). The EPGs give emergency planners–Army, State, and local–updated assessment of the chemical hazard and guidance on how to plan for a broad range of accidents by planning for a manageable number of accident categories. This paper addresses: (1) the rationale for updating the accident planning base; (2) the modeling methodology used to assess the chemical hazard; and (3) strategies that are advocated in the EPGs for the use of models by planners.

54 ENVIRONMENTAL SCIENCES

Refer also to citation(s) 23700, 23702, 25032

24442 (ANL/CMT-ACL/VU–83596) **Development of the Integrated Performance Evaluation Program (IPEP) for the Department of Energy's Office of Environmental Management.** Argonne National Lab., IL (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9410147–5-Vugraphs: 35. ORNL/DOE analytical chemistry in energy technology conference, Gatlinburg, TN (United States), 6-8 Oct 1994). Order Number DE95013496. Source: OSTI; NTIS; GPO Dep.

ASD's Quality Assurance Program assures production of credible environmental data. The Analytical Services Division (EM-263) is responsible for developing and implementing a comprehensive Integrated Performance Evaluation Program (IPEP) for laboratories providing analytical data in support of Environmental Management Programs. The Performance Evaluation Program describes a laboratory's ability to perform environmental analyses of radiochemical, hazardous chemical and mixed waste.

24443 (FZKA–5531) **Institute of Technical Chemistry. Report on research and development activities in 1994.** Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Inst. fuer Technische Chemie. [1995]. 60p. (In German). Order Number DE95790089. Source: OSTI; NTIS (US Sales Only).

This annual report describes the research and development activities of the Institute of Technical Chemistry of Forschungszentrum Karlsruhe. These covered, e.g.: Processes for thermal waste treatement, waste prevention and materials recycling, environmental pollutants, sewage treatment, purification of waste gases of technical processes. Further subjects were LWR safety, neutrino and particle physics, synthesis and structure of chemical complexes of heavy metals, microfocus X-ray technology, high-temperature gas purification.

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 23046, 23106, 23107, 23124, 23329, 23333, 23520, 23522, 23525, 23590, 23703, 23706, 23708, 23767, 23779, 23804, 23821, 23944, 23964, 24065, 24303, 24378, 24390, 24430, 24588, 24591, 24595, 24612, 24619, 24620, 24621, 24622, 24696, 24732, 24761, 24968

24444 (ANL/EA/CP–84904) **Sensitivities to source-term parameters of emergency planning zone boundaries for waste management facilities.** Mueller, C.J. Argonne National Lab., IL (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950430–8: 5. ANS topical meeting on emergency preparedness and response, Savannah, GA (United States), 18-21 Apr 1995). Order Number DE95013683. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reviews the key parameters comprising airborne radiological and chemical release source terms, discusses the ranges over which values of these parameters occur for plausible but severe waste management facility accidents, and relates the concomitant sensitivities of emergency planning zone boundaries predicted on calculated distances to early severe health effects.

24445 (ANL/ER/CP–84198) **An investigation of vertical winds obtained from vertically pointing and tilted beams of a five-beam 915-MHz wind profiler.** Coulter, R.L.; Martin, T.J. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9503104–5: 9. symposium on meteorological observations and instrumentation, Charlotte, NC (United States), 27-31 Mar 1995). Order Number DE95012265. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) Program has operated a 915-MHz radar wind profiler coupled with a Radio Acoustic Sounding System (RASS) since November 1992 at its Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) central facility in north central Oklahoma. The system is designed to provide continuous wind profiles from near the surface (100 m) to 5 km or more and virtual temperature profiles from near the surface to 1.5 km. During normal operation (see Table 1), the system uses four tilted beams (two each in the north-south and east-west vertical planes) and a single vertical beam to determine mean wind and virtual temperature profiles every hour. In this paper we illustrate and compare different methods for calculating w and several statistical variables from profiler data. The results are compared with those derived when the profiler is operated in a vertical-only mode under similar conditions.

24446 (ANL/ER/CP–85219) **A three-month comparison of hourly winds and temperatures from co-located 50-MHz and 915-MHz RASS profilers.** Coulter, R.L.; Holdridge, D.J. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9503104–4: 9. symposium on meteorological observations and instrumentation, Charlotte, NC (United States), 27-31 Mar 1995). Order Number DE95012266. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) Program has operated a 915-MHz and a 50-MHz radar wind profiler (boundary layer profiler (BLP) and tropospheric profiler (TP), respectively], each coupled with a Radio Acoustic Sounding System (RASS) since April 1994 at its Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) central facility in north central Oklahoma. The dual system is designed to provide continuous wind profiles from near the surface to 12 km or more and virtual temperature profiles from near the surface to 6 km. Because the BLP has a larger antenna than many other 915-MHz systems, the wind profiles sampled by the two systems overlap between 1.5 km and 5.5 km. The two systems are adjacent, so the wind profilers sample almost identical air masses in their overlap region during the averaging period. Nevertheless, the two RASS systems can be compared, and methods can be devised to estimate the temperature profile in the inaccessible region. Data used in all comparisons and calculations discussed below are

consensus-averaged values supplied by the profiler software. Although the spectra and moments from the data are available, they were not accessed for this analysis.

24447 (ANL/ER/CP–86001) **Comparison of satellite-derived and observer-based determinations of cloud cover amount at the SGP CART site.** Liaw, Y.P. (North Central College, Naperville, IL (United States). Dept. of Physics); Cook, D.R.; Sisterson, D.L.; Gao, W. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9503140–4: 5. atmospheric radiation measurement (ARM) meeting, San Diego, CA (United States), 20-23 Mar 1995). Order Number DE95012401. Source: OSTI; NTIS; GPO Dep.

Cloud-climate feedback is one of the most important factors in predicting the timing and magnitude of global climate change and its regional effects. Recent satellite measurements indicate that global effects of clouds on solar and infrared radiation are large. The experimental objective of the Atmospheric Radiation Measurement (ARM) Program is to characterize, empically, the radiative processes in the Earth's atmosphere with improved resolution and accuracy. Therefore, the effective treatment of cloud formation and cloud properties is crucial for reliable climate prediction. This study focuses on the analysis of cloud cover data for the ARM Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site central facility. The data set was obtained from the Advanced Very High Resolution Radiometer (AVHRR) on National Oceanic and Atmospheric Administration (NOAA) Satellites 11 and 12, and cloud observations made by SGP CART site operators. Such an analysis provides a basis for future evaluations with whole-sky cameras and provides a means of assessing the reliability of surface-based observations of cloud cover at the SGP CART site.

24448 (ANL/ER/CP–86626) **Performance of radar wind profilers, radiosondes, and surface flux stations at the SGP CART site.** Coulter, R.L. (Argonne National Lab., IL (United States). Environmental Research Div.); Lesht, B.M.; Wesely, M.L.; Cook, D.R.; Holdridge, D.J.; Martin, T.J. Argonne National Lab., IL (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9503140–8: 5. atmospheric radiation measurement (ARM) meeting, San Diego, CA (United States), 20-23 Mar 1995). Order Number DE95013464. Source: OSTI; NTIS; GPO Dep.

The performance of several routinely operating observational systems at the Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site has been evaluated. The results of a few specific investigations are shown here for Radar Wind Profilers (RWPs) and Radio Acoustic Sounding Systems (RASSs), Balloon-Borne Sounding Systems (BBSSs), and Energy Balance Bowen Ratio (EBBR) stations.

24449 (ANL/ES/CP–83898) **Estimation of monetary values of air pollutant emissions in various US areas.** Wang, M.Q.; Santini, D.J. Argonne National Lab., IL (United States). 17 Aug 1994. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950193–1: 74. annual transportation research board meeting, Washington, DC (United States), 11-15 Jan 1995). Order Number DE95013388. Source: OSTI; NTIS; GPO Dep.

Two general methods of estimating monetary values of air pollutants are presented in this paper. The damage estimate method directly estimated, air pollutant by simulating air quality, identifying health and other welfare impacts damage values and valuing the identified impacts of air pollution, and valuing the identified impacts. Although the method is theoretically sound, many assumptions are involved in each of its estimation steps, and uncertainty exists in each step. The control cost estimate method estimates the marginal emission control cost, which represents the opportunity cost offset by emission reductions from some given control measures. Studies conducted to estimate emission values in US regions used either the damage estimate method or the control cost estimate method. Taking emission values estimated for some US air basins, this paper establishes regression relationships between emission values and total population and air pollutant concentrations. On the basis of the established relationships, both damage-based and control-cost-based emission values are estimated for 17 major US urban areas.

24450 (ANL/ET/CP–85044) **Development of a millimeter-wave sensor for environmental monitoring.** Gopalsami, N.; Bakhtiari, S.; Raptis, A.C. Argonne National Lab., IL (United States). Jun 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950793–1: 40. annual meeting of the Society of Photo-Optical Instrumentation Engineers: international symposium on optical science, engineering and instrumentation, San Diego, CA (United States), 9-14 Jul 1995). Order Number DE95014228. Source: OSTI; NTIS; GPO Dep.

A millimeter-wave (mm-wave) sensor in the frequency range of 225-315 GHz is being developed for continuous emission monitoring of airborne effluents from industrial sites for environmental compliance monitoring and process control. Detection of chemical species is based on measuring the molecular rotational energy transitions at mm-wave frequencies. The mm-wave technique offers better transmission properties compared to optics in harsh industrial environments with smoke, dust, aerosols, and steam, as well as in adverse atmospheric conditions. The laboratory measurements indicate that polar molecules can be measured with a sensitivity of tens of parts-per-million-meter using this technology. Proof of principle of the open-path system was tested by releasing and detecting innocuous chemicals in the open air. It uses a monostatic radar configuration with transmitter and receiver on one side and a corner cube on tire other side of the plume to be measured. A wide-band swept frequency mm-wave signal is transmitted through the plume and return signal from the corner cube is detected by a hot-electron-bolometer. Absorption spectra of plume gases are measured by comparing the return signals with and without the plume in the beam path. Using signal processing based on deconvolution, high specificity of detection has been shown for resolving individual chemicals from a mixture. This technology is applicable for real-time measurement of a suite of airborne gases/vapors emitted from vents and stacks of process industries. A prototype sensor is being developed for wide-area monitoring of industrial sites and in-place monitoring of stack gases.

24451 (BNL–61619) **Modelling absorption and dilution of unconfined releases of hazardous gases by water curtains or monitors.** Fthenakis, V.M. (Brookhaven National Lab., Upton, NY (United States)); Blewitt, D.N.; Hague, W.J. Brookhaven National Lab., Upton, NY (United States). [1995]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950927–2: International conference and workshop on modeling and mitigating the consequences of accidental releases of hazardous materials, New Orleans, LA (United States), 26-29 Sep 1995). Order Number DE95011350. Source: OSTI; NTIS; GPO Dep.

OSHA Process Safety Management guidelines suggest that a facility operator investigate and document a plan for installing systems to detect, contain, or mitigate accidental releases if such systems are not already in place. In addition, proposed EPA 112(r) regulations would require such analysis. This paper illustrates how mathematical modelling can aid such an evaluation and describes some recent enhancements of the HGSPRAY model: (1) Adding algorithms for modeling NH_3 and LNG mitigation; (2) Modeling spraying of releases with fire water monitors encircling the point of release; (3) Combining wind tunnel modeling with mathematical modeling; and (4) Linking HGSPRAY and BEGADAS. Case cases are presented as examples of how HGSPRAY can aid the design of water spray systems for initiation of toxic gases (e.g., BF, NH_3) or dilution/dispersion of flammable vapors (e.g., LNG).

24452 (CONF-930133–12) **Impact of cloud microphysics on the CSU GCM atmospheric moisture budget.** Fowler, L.D.; Randall, D.A. Colorado State Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science. [1993]. 6p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract FG02-91ER61218. G atm-8907414. From 73. American Meteorological Society (AMS) annual meeting; Anaheim, CA (United States); 17-22 Jan 1993. Order Number DE95008978. Source: OSTI; NTIS; GPO Dep.

In this article, we present the first maps of the global distribution of the cloud liquid and ice water contents of the atmosphere. It is shown that the cloud microphysics package produces realistic distributions of both moisture variables. We axe presently adapting the present model so that long-term simulations with the CSU GCM may be made. In the near future, we plan to couple the cloud liquid and ice water contents prognosed by the cloud microphysics package with the cloud fraction and cloud optical properties.

24453 (CONF-940277–, pp. 1-3) **Single-column models as a bridge between observations and climate models.** Randall, D.A. (Colorado State Univ., Fort Collins, CO (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Among the several approaches to testing General Circulation Model (GCM) parameterizations by comparison with observations, single-column models (SCMs) have some unique advantages. Cloud ensemble models (CEMs) are a useful supplement to SCMs. They can be used in much the same way and have essentially the same data requirements. The data required to drive the SCMs and CEMs, and to evaluate their performance, are not easy to obtain. ARM, and especially the ARM SGP site, and especially the ARM SGP site during IOPs, has the potential to provide uniquely valuable data for SCM-based parameterization testing. Use of ARM data in SCMs and CEMs will be particularly valuable for testing cloud amount parameterizations.

24454 (CONF-940277–, pp. 5-9) **Quality measurement experiments within the Atmospheric Radiation Measurement Program.** Miller, N.E. (Pacific Northwest Lab., Richland, WA (United States)); Liljegren, J.C.; Shippert, T.R.; Clough, S.A.; Brown, P.D. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract AC06-76RL01830. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The general goal of the Atmospheric Radiation Measurement (ARM) Program is to improve general circulation and related models of the atmosphere for global and regional prediction (DOE 1990). To achieve this goal, ARM is collecting a prodigious volume of data at its first Cloud and Radiation Testbed (CART) facility in the Southern Great Plains. Because data must be of "known and reasonable" quality, quality measurement experiments (QMEs) are a critical part of the ARM quality assessment program. In this paper, we describe the general theory behind the QMEs, explain how they are implemented in the CART data environment, and give a brief synopsis of those implemented to date.

24455 (CONF-940277–, pp. 11-14) **Scale-invariance, non-stationarity and intermittency in the structure of cloudiness.** Wiscombe, W. (Goddard Space Flight Center, Greenbelt, MD (United States)); Davis, A.; Marshak, A.; Cahalan, R. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

One of the main goals of the Atmospheric Radiation Measurement (ARM) Program is to better understand cloud-radiation interaction in order to improve our climate forecasting skills. We use data on the distribution of atmospheric liquid water from a variety of sources, including ARM's routine ground-based retrievals, and a number of carefully selected statistical properties to obtain simple and robust yet dynamically relevant characterizations of cloudiness. These characterizations are a prerequisite for developing more realistic stochastic cloud models which can be used to investigate numerically rediative transfer issues, leading, in particular, to better GCM radiation schemes.

24456 (CONF-940277–, pp. 15-17) **Preliminary analysis of ground-based microwave and infrared radiance observations during the pilot radiation OBservation experiment.** Westwater, E.R. (Environmental Technology Lab., Boulder, CO (United States)); Han, Y.; Churnside, J.H.; Snider, J.B. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

During Phase Two of the Pilot Radiation OBservation Experiment (PROBE) held in Kavieng, Papuo New Guinea, the National Oceanic and Atmospheric Administration's Environmental Technology Laboratory (ETL) operated both microwave and infrared radiometers. Phase Two lasted from January 6 to February 28, 1993. The dramatic differences in the water vapor environment between the tropics and mid-latitudes were illustrated by Westwater et al. (1994) who presented PROBE data as well as additional data that were taken during the 1991 First ISCCP Regional Experiment (FIRE) II experiment in Coffeyville, Kansas. Here, we present an analysis of microwave data and preliminary analysis of infrared data obtained during PROBE.

24457 (CONF-940277–, pp. 19-25) **North Slope of Alaska and adjacent Arctic Ocean cloud and radiation testbed: Science and siting strategies.** Zak, B.D. (Sandia National Labs., Albuquerque, NM (United States)); Stamnes, K. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

This paper serves as a summary of the current thinking regarding the development of the Atmospheric Radiation Measurement (ARM) Program's North Slope of Alaska and adjacent Arctic Ocean (NSA/AAO) Cloud and Radiation Testbed (CART) site. The broad rationale for a high latitude (HL) CART site can be summarized as follows: Fundamentally different atmospheric and surface physics are important at high latitudes; High latitudes strongly influence global climate in a number of ways; Interpretation of satellite remote sensing data to obtain the distribution and character of high latitude clouds, snow and sea ice is an important, but poorly solved problem.

24458 (CONF-940277–, pp. 27-30) **Surface Heat Budget of the Arctic Ocean (SHEBA).** Curry, J.A. (Univ. of Colorado, Boulder, CO (United States)); Moritz, R.; Untersteiner, N.; Randall, D.A.; McPhee, M. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The interaction of the ocean and the atmosphere is a key to understanding and ultimately predicting global climate. Our present understanding is that Arctic air-sea-ice processes influence global climate by modifying the surface albedo and the global thermohaline circulation. Although the sensitivity of global climate to processes occuring in the Arctic Ocean is widely acknowledged, there is great uncertainty about the magnitude and overall effect. To improve our knowledge of Arctic and global climate requires multivariate data sets of two kinds: An accurate climatology, including monthly mean values and variances for the major quantities that characterize the Arctic air-sea-ice system; and, Detailed process-oriented data sets that document the simultaneous temporal variations of the coupled atmosphere-sea ice-ocean system on time scales of hours to a year. To address these issues, a program, Surface Heat Budget of the Arctic Ocean (SHEBA) that will combine in situ observations, satellite remote sensing, analysis and modeling has been proposed. To achieve the overall scientific goals of SHEBA, the following specific issues will be addressed:

Surface heat and mass budget; Arctic clouds; Upper ocean interactions; and, Coupled sensitivity of ice, atmosphere and ocean. To meet the goals and scientific objectives of SHEBA will require the following components: a one-year filed program over the Arctic Ocean pack ice, a satellite remote sensing component, and a modeling component.

24459 (CONF-940277–, pp. 31-38) **Overview of North Slope of Alaska/adjacent Arctic Ocean Science issues.** Ellingson, R.G. (Univ. of Maryland, College Park, MD (United States)); Curry, J.A.; Stamnes, K.; Walsh, J.E.; Zak, B.D. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The following material is based on presentations made during the ARM Science Team Meeting concerning the scientific issues to be addressed at the North Slope of Alaska/Adjacent Arctic Ocean (NSA/AAO) Atmospheric Radiation Measurement (ARM) Site and how these and complementary issues are being addressed in other national and international programs. The scientific objectives for the NSA/AAO site, which are to be achieved in cooperation with Surface Heat Budget of the Arctic Ocean (SHEBA) and the First ISCCP Regional Experiment (FIRE)III, include the following: The radiative effects of mixed phase and ice phase clouds, aerosols, and cloud-aerosol mixtures; Description of basic cloud microphysical properties and the influence of atmospheric thermodynamics; The relative importance of surface and advective fluxes of moisture in the formation of clouds; The sensitivity of the boundary layer clouds to large-scale vertical motion; Interactions among turbulence, radiation, and cloud microphysical processes; The radiative effects of the horizontally inhomogeneous summertime stratocumulus clouds over the horizontally inhomogeneous, melting snow/sea ice surface; Response of surface albedo and ablation as a response to energy inputs.

24460 (CONF-940277–, pp. 39-40) **Atmospheric Radiation Measurement Program - unmanned aerospace vehicle: The follow-on phase.** Vitko, J. Jr. (Sandia National Labs., Livermore, CA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Unmanned Aerospace Vehicle (UAV) demonstration flights (UDF) are designed to provide an early demonstration of the scientific utility of UAVs by using an existing UAV and instruments to measure broadband radiative flux profiles under clear sky conditions. UDF is but the first of three phases of ARM-UAV. The second phase significantly extends both the UAV measurement techniques and the available instrumentation to allow both multi-UAV measurements in cloudy skies and extended duration measurements in the tropopause. These activities build naturally to the third and final phase, that of full operational capability, i.e., UAVs capable of autonomous operations at 20-km altitudes for multiple days with a full suite of instrumentation for measuring radiative flux, cloud properties, and water vapor profiles.

24461 (CONF-940277–, pp. 41-44) **Summary of single-column model intensive observation period workshop at annual atmospheric radiation measurement science team meeting.** Randall, D.A. (Colorado State Univ., Fort Collins, CO (United States)); Cederwall, R.T. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The objectives of this working group are to: Review recently completed winter single-column model (SCM) intensive observation period (IOP), including data collected and delivery schedule to Atmospheric Radiation Measurement (ARM) Science Team; Evaluate adequacy of measurements (value-added data) available from recent and future SCM IOPs; Recommend changes and additions to ARM observation strategies, external data acquisition, and data algorithms to enhance SCM efforts in ARM; Increase the interaction among SCM investigators and facilitate interaction with and guidance of the ARM infrastructure support of SCM activities within ARM.

24462 (CONF-940277–, pp. 45-46) **Unmanned Aerospace Vehicle Workshop.** Vitko, J. Jr. (Sandia National Labs., Livermore, CA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The Unmanned Aerospace Vehicle (UAV) Workshop concentrated on reviewing and refining the science experiments planned for the UAV Demonstration Flights (UDF) scheduled at the Oklahoma Cloud and Radiation Testbed (CART) in April 1994. These experiments were focused around the following sets of parameters: Clear sky, daylight; Clear-sky, night-to-day transition; Clear sky - improve/validate the accuracy of radiative fluxes derived from satellite-based measurements; Daylight, clouds of opportunity; and, Daylight, broken clouds.

24463 (CONF-940277–, pp. 47-53) **Calibration of radiation codes used in climate models: Comparison of clear-sky calculations with observations from the spectral radiation experiment and atmospheric radiation measurement program.** Ellingson, R.G. (Univ. of Maryland, College Park, MD (United States)); Shen, S.; Warner, J. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The InterComparison of Radiation Codes in Climate Models (CRCCM) showed large differences between model calculations of longwave fluxes and heating rates - even for clear sky conditions. Discrepancies could not be resolved and eventually the Atmospheric Radiation Measurement (ARM) Program arose to conduct spectral radiation experiments to resolve the discrepancies. The long term objectives of the study are to: Determine the range of agreement between longwave observations and model calculations ranging from line-by-line models to those used in climate models; Understand the causes for the differences between calculations and observations; and, Determine improved parameterizations for use in climate models. This paper summarizes preliminary results obtained from the comparisons of calculations made by different models with observations obtained during the SPECTRE and ARM. The study is limited at this time to clear-sky conditions because we believe it is necessary to ascertain the performance of radiation models under these conditions in order to more fully understand observations made under more general cloudy conditions.

24464 (CONF-940277–, pp. 65-69) **Explicit simulation of a tropical mesoscale convective system.** Alexander, G.D. (Colorado State Univ., Fort Collins, CO (United States)); Cotton, W.R. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract FG02-90ER61066 ; FG03-94ER61749. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

We have used Colorado State University's Regional Atmospheric Modeling System (RAMS) to simulate the MCS observed during the ninth flight mission of the Equatorial Mesoscale Experiment (EMEX9). Research aircraft probed EMEX9 on 2-3 February 1987. RAMS successfully captures the observed characteristics of EMEX9, including temporal initiation, geographic location, speed

and direction of motion of the system, spatial arrangement of the convective cells and stratiform region, and updraft and downdraft speeds. We have used several different kinds of analysis techniques in order to distill the copious amounts of data provided by the simulation into some coherent view of EMEX9. Conditional sampling of model output uncovers a strange convergence maximum at about 10 km in the intermediary region - perhaps a physical footprint of the production of EMEX9's vast stratiform anvil. Applying the RAMS LPDM enables us to identify the major simulated flow branches, including a conspicuous front-to-rear ascending flow branch. Analysis of vertical forcing terms along this flowbranch shows that a brief burst of upward directed vertical pressure gradient force initiates the ascent before upward buoyancy dominates, consistent with the idea that some trigger is needed to force ascent into a conditionally unstable atmosphere.

24465 (CONF-940277–, pp. 71-73) **A comparison of model-simulated relative humidity with satellite-derived cloudiness.** Alliss, R.J. (North Carolina State Univ., Raleigh, NC (United States)); Raman, S. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. Contract 091575-A-Q1. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

One of the unresolved problems in climate and numerical weather prediction is the treatment of cloudiness. In the real atmosphere, clouds are interactively linked to dynamical, hydrological, turbulent, and radiative processes over scales ranging from the microphysics of cloud particles to the synoptic and planetary scales of extensive multi-layered clouds. In current general circulation models (GCMs), clouds are not related to the hydrological cycle; they exist only for their direct impact on the radiation fields, and their characteristics (horizontal cover, height, optical properties) are either held constant or diagnosed from a limited set of parameters. Many modelers have relied on resolvable-scale relative humidity for diagnosing non-convective cloudiness. Methods for linking clouds to the hydrological cycle or to the turbulent processes in GCMs are still in their infancy, although it is possible that liquid water will be explicitly predicted in the next generation of GCMs. Few comparisons of observed clouds and related relative humidity fields have actually been performed so far because of the lack of adequate cloud climatologies and atmospheric data sets allowing one to make verifications. The recent availability of the International Satellite Cloud Climatology Project (ISCCP) data sets, a consistent and global cloud climatology, is of great interest for climate research; however, the resulting cloud climatology (consisting of 30-day means of cloud characteristics averaged over approximately [250 km^2]) may not be sufficient for validating cloud generation schemes. The comparison of model-generated parameters associated with observed cloudiness requires a more detailed approach: for example, model-generated relative humidity must be compared with observed cloudiness for a variety of meteorological situations, and the results must be examined in terms of physically significant and predictable parameters.

24466 (CONF-940277–, pp. 75-80) **MODTRAN3: Suitability as a flux-divergence code.** Anderson, G.P. (Phillips Lab., Hanscom Air Force Base, MA (United States)); Chetwynd, J.H.; Wang, J.; Hall, L.A.; Kneizys, F.X.; Kimball, L.M.; Bernstein, L.; Acharya, P.; Berk, A.; Robertson, D.C. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The Moderate Resolution Atmospheric Radiance and Transmittance Model (MODTRAN3) is the developmental version of MODTRAN and MODTRAN2. The Geophysics Directorate, Phillips Laboratory, released a beta version of this model in October 1994. It encompasses all the capabilities of LOWTRAN7, the historic 20 cm^{-1} resolution (full width at half maximum, FWHM) radiance code, but incorporates a much more sensitive molecular band model with 2 cm^{-1} resolution. The band model is based directly upon the HITRAN spectral parameters, including both temperature and pressure (line shape) dependencies. Validation against full Voigt line-by-line calculations (e.g., FASCODE) has shown excellent agreement. In addition, simple timing runs demonstrate potential improvement of more than a factor of 100 for a typical 500 cm^{-1} spectral interval and comparable vertical layering. Not only is MODTRAN an excellent band model for "full path" calculations (that is, radiance and/or transmittance from point A to point B), but it replicates layer-specific quantities to a very high degree of accuracy. Such layer quantities, derived from ratios and differences of longer path MODTRAN calculations from point A to adjacent layer boundaries, can be used to provide inversion algorithm weighting functions or similarly formulated quantities. One of the most exciting new applications is the rapid calculation of reliable IR cooling rates, including species, altitude, and spectral distinctions, as well as the standard spectrally integrated quantities. Comparisons with prior line-by-line cooling rate calculations are excellent, and the techniques can be extended to incorporate global climatologies of both standard and trace atmospheric species.

24467 (CONF-940277–, pp. 85-89) **Radiation impacts on global climate models.** Baer, F. (Univ. of Maryland, College Park, MD (United States)); Arsky, N.; Rocque, K. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Climate models are driven by forcing, and these forces are seen primarily by the thermal field in general circulation models (GCMs). The major forces that affect the thermal field are longwave radiative (LWR) heating, shortwave radiative (SWR) heating, and convection (cumulus, etc.). These forcing effects are cycled through the thermal field to the motion field by nonlinear transfer. The dependent variables - in particular , temperature, moisture and clouds - evolve in time in a model and determine the subsequent forcing. If the dependent variables are not accurately calculated in space and time, the forcing functions will be adversely affected.It is thus imperative to determine how sensitive these forces are to the input variables. The authors tested the sensitivity of various LWR heating algorithms taken from general circulation models . The algorithms were tested on a variety of data profiles to cover different geographic regions and seasons.

24468 (CONF-940277–, pp. 91-94) **Measurements and modeling of the effect of convective clouds on the upper tropospheric moisture budget.** Bisson, S.E. (Sandia National Labs., Livermore, CA (United States)); Goldsmith, J.E.M.; Del Genio, A.D. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The goal of this study is to determine the upper tropospheric moisture budget associated with convective events and, in particular, to extend process models to higher altitudes than have been achieved previously. Although upper tropospheric moisture concentrations are several orders of magnitude lower than those near the surface, upper tropospheric moisture exerts an important influence on climate. On a per-molecule basis, greenhouse absorption due to water vapor is about one hundred times more effective at high altitudes than at low altitudes. Several one-dimensional radiative convective models have been used to demonstrate the importance of upper tropospheric moisture on climate. These models show that for a given fractional increase in water vapor at a given altitude, the response or change in surface temperature is qualitatively the same. Figure 1 shows the change in surface temperature for a 50% increase of the specific humidity in a 40-mbar layer in clear skies. At present, considerable controversy exists over the nature of the vertical redistribution of water vapor in a changing climate, particularly the distribution of water vapor in the upper troposphere.

Because suitable data are lacking, this controversy is also reflected in the cumulus parameterization schemes currently used in models. Understanding upper tropospheric moistening processes is therefore of prime importance in addressing the water vapor feedback question.

24469 (CONF-940277–, pp. 95-98) **Factors influencing the parameterization of tropical anvils within general circulation models.** Bradley, M.M. (Lawrence Livermore National Lab., CA (United States)); Chin, H.N.S. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The overall goal of this project is to improve the representation in general circulation models (GCMs) of anvil clouds and their effects. We have concentrated on an important portion of the overall goal; the evolution of cumulus-generated anvil clouds and their effects on the large-scale environment. Because of the large range of spatial and temporal scales involved, we have been using a multi-scale approach. For the early-time generation and development of the cirrus anvil, we are using a cloud-scale model with a horizontal resolution of 1-2 kilometers, while for the transport of anvils by the large-scale flow, we are using a mesoscale model with a horizontal resolution of 10-40 kilometers. The eventual goal is to use the information obtained from these simulations, together with available observations, to develop an improved cloud parameterization for use in GCMs. The cloud-scale simulation of a midlatitude squall line case and the mesoscale study of a tropical anvil using an anvil generator were presented at the last Atmospheric Radiation Measurement (ARM) science team meeting. This paper concentrates on the cloud-scale study of a tropical squall line. Results are compared with its midlatitude counter-parts to further our understanding of the formation mechanism of anvil clouds and the sensitivity of radiation to their optical properties.

24470 (CONF-940277–, pp. 99) **Comparison of stochastic radiation transfer predictions with multi-filter rotating shadowband radiometer data.** Byrne, N. (Science Applications International Corp., San Diego, CA (United States)); Ramanathan, G.; Malvagi, F. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

There are many proposed models for estimating the effects of broken cloud on radiative transfer in the context of a general circulation model (GCM). These schemes are required to be very fast and to require only a modest amount of met data. To be worthy of consideration, they must offer improvement over a simple fractional cloud cover (FCC) prediction. We describe the initial results of the use of multi-filter rotating shadowband radiometer (MFRSR) data from the Atmospheric Radiation Measurement (ARM) Program to compare a model we have proposed (the simplest Pomraning-Levermore [PL] equation set) with FCC. Because the required sitewide solar fluxes are not yet available, we have used five successive days in late May 1993 with roughly similar climatology at the (only available) instrument to stand for five separate readings of the same day. The cloud size data required for PL and the fractional area coverage required for FCC were taken from Geostationary Operational Environmental Satellite (GOES) observations for the same period. As it turned out, conditions for this particular period were such that the two methods give indistinguishable predictions, but the method is established and the expected availability of much more data in the near future should allow definitive results.

24471 (CONF-940277–, pp. 101-109) **Residual analysis of surface spectral radiances between instrument observations and line-by-line calculations.** Clough, S.A. (Atmospheric and Environmental Research, Inc., Cambridge, MA (United States)); Brown, P.D.; Miller, N.E.; Liljegren, J.C.; Shippert, T.R. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract FG02-90ER61064. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The evaluation and improvement of radiative transfer calculations are essential to attain improved performance of general circulation models (GCMs) for climate change applications. The focus of the study described here is a critical assessment of a radiative transfer experiment conducted under the Department of Energy's Atmospheric Radiation Measurement Program (ARM). The three principal components of the study are (1) ground-based measurement of the spectral radiances, (2)characterization of the atmospheric state associated with the radiating column, and (3) evaluation of the line-by-line radiative transfer model. The experiment will be continuous (once per hour) and will be conducted over an extended period of time (up to 10 years), important requirements for climate change applications. With respect to global coverage, the first experiment is being conducted in the Southern Great Plains of the United States, with subsequent sites planned for climatologically diverse locations. The initial focus of the experiment is on longwave radiative transfer for clear sky; we plan to extend the approach to include the shortwave and atmospheres with clouds and aerosols. Evaluation of the present radiation modeling capability is best achieved by using statistical analyses of the residuals between observed and calculated spectral radiances. Spectral radiances are calculated using the Line by Line Radiative Transfer Model (LBLRTM) in conjunction with the HITRAN92 line parameter database. Radiance residuals provide a direct indication of all three components of the experiment by physical process. In the context of the present study, an example of a physical process is the radiance from spectral lines in a specific vibration-rotation band of water vapor.

24472 (CONF-940277–, pp. 111-113) **Development of a scheme for parameterizing the effects of cloud condensation nuclei on stratocumulus cloud albedo.** Cotton, W.R. (Colorado State Univ., Fort Collins, CO (United States)); Stevens, B.; Duda, D.; Stephens, G.L. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. Contract NIGEC-91-S01. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop a scheme for parameterizing the effects of varying concentrations of cloud condensation nuclei (CCN) on stratocumulus cloud albedo for use in global climate models. The challenges in achieving this goal are: CCNs are not a horizontally and vertically uniform species, but vary depending upon differential horizontal advection of differing CCN sources and upon local conditions (e.g., CCN formation by gas-to-particle conversion and cloud removal). CCNs are probably as variable as water vapor. The peak supersaturations that determine the activation of CCN and resultant aerosol and cloud droplet distributions are a function of cloud updraft and downdrafts on scales of a few hundred meters with magnitudes of a few meters per second. These scales cannot be represented properly either with large-scale grid-resolvable ascent rates of the order of 0.01 m/s or by eddy diffusion models. Cloud albedo is a strong function of the cloud macrostructure (holes, hills, troughs in cloud structure) and of the liquid water paths and aerosol/hydrometeor spectra. The aerosol/hydrometeor spectra, in turn, are not only a function of nucleation of cloud droplets at cloud base on resident CCN in the atmospheric boundary layer (ABL), but also the entrainment of CCN from above the capping inversion and the formation of drizzle. (Entrainment is one of the most difficult processes to model in the cloud-topped boundary layer [CTBL]). Drizzle formation is a complicated function of the CCN spectra, especially giant and ultra-giant aerosol, cloud liquid water contents, mixing processes, and the time scales of cloud drafts which are determined by the strengths and depths of cloud drafts.

24473 (CONF-940277–, pp. 119-125) **Modeling and observing the optical thickness of low clouds.** Del Genio, A.D. (Goddard Institute for Space Studies, New York, NY (United States)); Yao, M.S.; Kovari, W.; Wolf, A.B. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

A substantial portion of the disagreement in cloud feedback among various general circulation models (GCMs) can be traced to the models differing representations of the optical thickness of low-level clouds. Implicit cloud optical thickness feedback arises when the optical properties are prescribed as a function of height, because cloud height typically increases in model simulations of a warming climate. If the optical thickness decreases with height, a positive low cloud optics feedback results. Diagnostic parameterizations, in which optical thickness is assumed to increase with temperature based on, e.g., a calculation of the adiabatic liquid water content of a moist lifted air parcel, produce a negative cloud optics feedback because the albedo effect dominates the greenhouse effect for low-level clouds. Prognostic schemes, in which cloud liquid/ice water is predicted as a function of time based on a cloud water budget and the optical properties diagnosed from the cloud water content, can produce either positive, neutral, or negative cloud optics feedbacks because such schemes incorporate both sources and sinks of cloud water. To date, no observational or theoretical consensus has emerged on the temperature dependence of the optical thickness of low clouds. Aircraft observations over the former Soviet Union indicate that the liquid water content of low and middle clouds increases with temperature except perhaps at the warmest temperatures. Researchers used this indication as the basis of an optical thickness feedback simulation in a one-dimensional radiative-convective (1DRC) model, illustrating the potentially large negative cloud optics feedback. Others used simple thermodynamic arguments to calculate the temperature dependence of adiabatic liquid water content, with similar implications for low cloud optical thickness feedback. There is no obvious liquid water path dependence on temperature in satellite microwave measurements over the North Atlantic.

24474 (CONF-940277–, pp. 127-130) **Mesoscale simulations of convective systems with data assimilation during June 1993 in the Southern Great Plains.** Dudhia, J. (National Center for Atmospheric Research, Boulder, CO (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract AI05-90ER61070. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

An intensive observation period (IOP) took place at the Southern Great Plains Cloud and Radiation Testbed (CART) site from June 16-26,1993. Additional observations came from two integrated sounding systems (ISSs) and three National Center for Atmospheric Research (NCAR) cross-chain loran atmospheric sounding system (CLASS) sites to complement the central CART site and the seven National Weather Service (NWS) profilers of the demonstration network in the area. The NCAR/Penn State Mesoscale Model (MM5) has been used to simulate this period on a 60-km domain with 20- and 6.67-km nests centered on Lamont, Oklahoma. Simulations are being run with data assimilated by the nudging technique to incorporate upper-air and surface data from a variety of platforms. One goal of this work is to use all the available data collected in the Southern Great Plains CART area in conjunction with a continuously running mesoscale model to provide complete hourly datasets of the wind, temperature, humidity, and cloud distributions at high resolution. The model maintains dynamical consistency between the fields, while the data correct for model biases that may occur during long-term simulations and provide boundary conditions. In this study the feasibility of driving the model with surface data, rawinsonde data, profiler winds, microwave radiometer moisture data, and radio-acoustic sounding system (RASS) temperatures is being demonstrated. The dataset provided will be a valuable resource for comparison with general circulation model (GCM) parameterizations of cloud and radiation fields, as well as for mesoscale studies of convective events during this period.

24475 (CONF-940277–, pp. 131-135) **Surface flux intercomparison between the MM5 model and observations during the storm-scale observations regional measurement program - fronts experiment systems test 1992.** Dudhia, J. (National Center for Atmospheric Research, Boulder, CO (United States)); Oncley, S.P. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract AI05-90ER61070. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Mesoscale model 5 (MM5) is being used as a data assimilation tool for the Atmospheric Radiation Measurement (ARM) Program. There is a need to verify that the model physics is consistent with observations under a range of conditions. Surface fluxes of heat, moisture, and momentum are a particular area of uncertainty in the model owing to their dependence on surface properties, some of which are time-dependent. The National Center for Atmospheric Research (NCAR) Atmosphere-Surface Turbulent Exchange Research (ASTER) facility provides direct measurements of the fluxes near the surface by means of three-dimensional sonic anemometers collocated with fast-response temperature and humidity sensors. Additionally aircraft data from a low-flying King aircraft have been taken over the ASTER site. The primary objective is to detect any systematic errors in the MM5 surface flux formulation that could have adverse effects on the model data assimilation and, thence, to suggest corrections that help avoid such inaccuracies.

24476 (CONF-940277–, pp. 137-139) **Cloud microphysical and radiative properties measured by combined lidar, radar, and infrared radiometer.** Eberhard, W.L. (National Oceanic and Atmospheric Administration, Boulder, CO (United States)); Intrieri, J.M.; Chan, K.P.; Feingold, G. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The goal of our research in the Instrument Development Program (IDP) is to provide experimental descriptions of the bulk, microphysical, and radiative parameters of clouds (especially cirrus) and the relationships between these properties, for use in developing and validating climate models. The strategy of the Atmospheric Lidar Division of our laboratory is to develop remote sensing techniques to simultaneously measure important cloud parameters and to apply these new methods and older ones in case studies and statistical investigations. Our division participated with the University of Utah on technique development during the first three years of IDP including field tests locally and at FIRE II. The Atmospheric Radiation Measurement (ARM) Program also helped fund demonstration of new technology at the Atlantic Stratocumulus Transition EXperiment (ASTEX). Our current research under a new, independent grant comprises four tasks, which are summarized.

24477 (CONF-940277–, pp. 141-144) **Radar/radiometer retrievals of cloud liquid water and drizzle: Analysis using data from a three-dimensional large eddy simulation of marine stratocumulus clouds.** Feingold, G. (Univ. of Colorado, Boulder, CO (United States)); Frisch, A.S.; Stevens, B.; Cotton, W.R. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. Contract 164514-A-91. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Marine stratocumulus clouds are believed to play an important role in the earth's energy budget through their effect on the radiation budget. To evaluate the impact of stratocumulus clouds on climate, long-term cloud monitoring with extensive spatial coverage is imperative. Central to this problem are measurements of cloud liquid water and drizzle. This need prompted the National Oceanic and Atmospheric Administration's (NOAA) Environmental Technology Laboratory to develop techniques for retrieving cloud liquid water content and drizzle characteristics using a K_α-band Doppler radar and microwave radiometer. The instruments were deployed on the island of Porto Santo in the Madeiras during the recent Atlantic Stratocumulus Transition EXperiment (ASTEX), June 1992. Unfortunately, there were no useful overflights of the island, and there are no direct in situ measurements against which to compare the remote measurements. In this paper, we will use a data set generated by a three-dimensional (3-D) large eddy simulation (LES) model as a surrogate for real data. The model results presented do not represent an ASTEX case study; they are simply synthetic data of a marine stratocumulus capped boundary layer which are used to analyze the behavior of the remote sensing retrievals. The model is the Regional Atmospheric Modeling System (RAMS) developed at Colorado State University. The version used includes explicit treatment of cloud condensation nucleus and droplet size spectra. Because RAMS is able to resolve droplet size distributions, it is ideal for comparing various integrated moments of the distribution (e.g., LWC, Z, etc.) with similar parameters measured either in situ or by remote sensors. Model-derived information on droplet spectra and vertical velocities is used to calculate radar reflectivity factors, Doppler velocity spectra, and integrated liquid water paths (LWP). These parameters are then used as input to the retrieval method.

24478 (CONF-940277–, pp. 145-148) **Scanning Raman lidar measurements of atmospheric water vapor and aerosols.** Ferrare, R.A. (Hughes STX Corp., Lanham, MD (United States)); Evans, K.D.; Melfi, S.H.; Whiteman, D.N. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The principal objective of the Department of Energy's (DOE) Atmospheric Radiation Measurement Program (ARM) is to develop a better understanding of the atmospheric radiative balance in order to improve the parameterization of radiative processes in general circulation models (GCMs) which are used to study climate change. Meeting this objective requires detailed measurements of both water vapor and aerosols since these atmospheric constituents affect the radiation balance directly, through scattering and absorption of solar and infrared radiation, and indirectly, through their roles in cloud formation and dissipation. Over the past several years, we have been investigating how the scanning Raman lidar developed at the NASA/Goddard Space Flight Center (GSFC) can provide the water vapor and aerosol measurements necessary for such modeling. The lidar system has provided frequent, high resolution profiles of atmospheric water vapor and aerosols in nighttime operations during two recent field experiments. The first experiment was ATMIS-11 (Atmospheric Moisture Intercomparison Study) conducted in July-August 1992, and the second was the Convection and Moisture Experiment (CAMEX) conducted during September-October 1993. We present a brief description of the lidar system and examples of the water vapor and aerosol measurements acquired during these experiments.

24479 (CONF-940277–, pp. 149-150) **Stratus cloud measurements with a K_α-band Doppler radar and a microwave radiometer.** Frisch, A.S. (National Oceanic and Atmospheric Administration, Boulder, CO (United States)); Fairall, C.W.; Snider, J.B.; Lenschow, D.H. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. Contract 164514-a-91. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The goal of the Atlantic Stratocumulus Transition Experiment (ASTEX) held in the North Atlantic during June 1992 was to determine the physical reasons for the transition from stratocumulus to broken clouds. Some possible reasons for this transition were such things as cloud top entrainment instability and the decoupling effects of drizzle. As part of this experiment, the Environmental Technology Laboratory's cloud sensing Doppler radar and three-channel microwave radiometer were deployed in the island of Porto Santo in the Madeira Islands of Portugal along with a carbon dioxide Doppler lider. Drizzle properties in stratus were examined using a log-normal droplet distribution model that related the model's three parameters to the first three Doppler spectral moments of the cloud radar. With these moments, we are then able to compute the drizzle droplet concentration, modal radius, liquid water, and liquid water flux as a function of height.

24480 (CONF-940277–, pp. 151-155) **A stratiform cloud parameterization for general circulation models.** Ghan, S.J. (Pacific Northwest Lab., Richland, WA (United States)); Leung, L.R.; Chuang, C.C.; Penner, J.E.; McCaa, J. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract AC06-76RL01830. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The crude treatment of clouds in general circulation models (GCMs) is widely recognized as a major limitation in applying these models to predictions of global climate change. The purpose of this project is to develop a parameterization for stratiform clouds in GCMs that expresses stratiform clouds in terms of bulk microphysical properties and their subgrid variability. In this parameterization, precipitating cloud species are distinguished from non-precipitating species, and the liquid phase is distinguished from the ice phase. The size of the non-precipitating cloud particles (which influences the cloud radiative properties and the conversion of non-precipitating cloud species to precipitating species) is determined by predicting both the mass and number concentrations of each species.

24481 (CONF-940277–, pp. 157-159) **Implementation of Raman lidar for profiling of atmospheric water vapor and aerosols at the Southern Great Plains Cloud and Radiation Testbed Site.** Goldsmith, J.E.M. (Sandia National Labs., Livermore, CA (United States)); Bisson, S.E.; Blair, F.H.; Whiteman, D.N.; Melfi, S.H.; Ferrare, R.A. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

There are clearly identified scientific requirements for continuous profiling of atmospheric water vapor at the Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site. Research conducted at several laboratories, including our own collaboration in a previous Instrument Development Project for the Atmospheric Radiation Measurement (ARM) Program, has demonstrated the suitability of Raman lidar for providing measurements that are an excellent match to those requirements. We are currently building a rugged Raman lidar system that will reside permanently at the CART site and that is computer-automated to reduce the requirements for operator interaction. In addition to the design goal of profiling water vapor through most of the troposphere during nighttime and through the boundary layer during daytime, the lidar is intended to provide quantitative characterizations of aerosols and clouds, including depolarization measurements for particle phase studies. Raman lidar systems detect selected species by monitoring the wavelength-shifted molecular return produced by Raman scattering from the chosen molecule or molecules. For water-vapor measurements, the nitrogen Raman signal is observed simultaneously with the water-vapor Raman signal; proper ratioing of the signals yields the water-vapor mixing ratio. Similarly, when the

backscatter signal at the laser wavelength (which contains contributions from both Rayleigh and aerosol scattering) is also recorded simultaneously, the ratio of the backscatter signal to the nitrogen Raman signal yields a quantitative measurement of the aerosol scattering ratio. A variety of aerosol and cloud parameters can be derived from this measurement. In aerosol-free regions of the atmosphere, temperature profiles can be derived from the density measurements obtained from the nitrogen Raman signal.

24482 (CONF-940277–, pp. 161-165) **On the fundamental role of tropospheric radiative cooling on the diurnal cycle of intense tropical convection.** Gray, W.M. (Colorado State Univ., Ft. Collins, CO (United States)); Sheaffer, J.D.; Thorson, W. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract FG03-94ER61772. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The atmosphere performs a day versus night (DVN) radiation experiment each 24 hours. This research seeks to more accurately describe the main aspects of the diurnally varying heating, moisture, rainfall, circulation, cloudiness and related cycles of the tropical atmosphere. These studies focus on the following areas: Revised diagnostic studies of the diurnal cycle, arising in part from the principal investigator's prior work in the area, but expanded to include the vast new and improved tropical data bases now available; New initiatives in the analysis of the diurnal cycle on larger space scales and its variability in interannual time frames; Participation in the TWP-CART field program; and, Collaborative interactions with general circulation model (GCM) research groups to better maintain the focus of our work on mutually beneficial outcomes.

24483 (CONF-940277–, pp. 167-171) **Testing of Newtonian nudging technique in data assimilation on the meso-beta-scale.** Guo, Y.R. (National Center for Atmospheric Research, Boulder, CO (United States)); Kuo, Y.H. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The Newtonian nudging technique is a practical and flexible method for synoptic scale and meso-α-scale data assimilation. Application of the nudging technique for meso-β-scale data assimilation has been rare. As part of the development of an Integrated Data Assimilation and Sounding System in support of the ARM measurement program, the authors have experimented with the Newtonian nudging technique for meso-β-scale data assimilation. With the meso-β-scale dataset (station separation is 90 km) available in WISP/ARM-91, the optimal nudging coefficient G is around 1×10^{-3} s^{-1} for a high-resolution (5 km) mesoscale model. A good choice of radius of influence R is a value close to the station separation. In this study, R = 50 km gives smaller errors, and neither the noise parameter nor the wind rms errors are sensitive to the radius of influence for $R \geq 50$ km.

24484 (CONF-940277–, pp. 173-180) **Toward an operational water vapor remote sensing system using the global positioning system.** Gutman, S.I. (National Oceanic and Atmospheric Administration, Boulder, CO (United States)); Chadwick, R.B.; Wolf, d.W.; Simon, A.; Van Hove, T.; Rocken, C. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Water vapor is one of the most important constituents of the free atmosphere since it is the principal mechanism by which moisture and latent heat are transported and cause weather. Recent experiments have demonstrated that data from Global Positioning System (GPS) satellites can be used to monitor precipitable water vapor (PWV) with millimeter accuracy and sub-hourly temporal resolution. Major advantages of GPS-based systems include the following: they work under virtually all weather conditions; individual systems do not have to be calibrated; and, they are relatively inexpensive.

24485 (CONF-940277–, pp. 181-184) **Comparisons of brightness temperature measurements and calculations obtained during the spectral radiance experiment.** Han, Y. (National Oceanic and Atmospheric Administration, Boulder, CO (United States)); Snider, J.B.; Westwater, E.R.; Melfi, S.H.; Ferrare, R.A. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

In radiometric remote sensing of the atmosphere, the ability to calculate radiances from underlying state variables is fundamental. To infer temperature and water vapor profiles from satellite- or ground-based radiometers, one must determine cloud-free regions and then calculate clear-sky radiance emerging from the top of the earth's atmosphere from the underlying profiles of temperature and water vapor. Equally important is the validation of the radiometric retrievals. Usually such validation is made by comparing retrievals with profiles derived from other sensors. Traditionally, such "forward model" calculations and validations have coupled radiosonde observations of the state variables with detailed absorption and radiative transfer models. However, for a variety of reasons, radiosonde moisture measurements are not always satisfactory, especially during low humidity conditions or when there are large horizontal or temporal gradients in the humidity structure. A recent alternative to radiosonde moisture measurements is Raman lidar. The Raman lidar provides humidity measurements with temporal and spatial resolution far superior to radiosonde measurements. In November-December 1991, a substantial number of remote sensor and in-situ instruments were operated together in Coffeyville, Kansas, during the First ISCCP Regional Experiment (FIRE) 11. Included in the suite of instruments were (1) the Environmental Technology Laboratory's (ETL) three-channel microwave radiometer, (2) the NASA/Goddard Space Flight Center's (GSFC) Raman lidar, (3) ETL's radio acoustic sounding system (RASS), and (4) frequent research-quality radiosondes. The Raman lidar operated only at night, and this portion of the experiment focused on cloud-free conditions. In this presentation, we present results of simultaneous microwave radiometer measurements with collocated Raman lidar measurements of water vapor over 10 nights during the experiments.

24486 (CONF-940277–, pp. 185-191) **Vegetation forcing and convective motion.** Hong, X. (North Carolina State Univ., Raleigh, NC (United States)); Leach, M.J.; Raman, S. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. Contract 091575-A-Q1. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

A large irrigated vegetation area in a semiarid or relatively dry location is a strong surface forcing of thermal circulations. Several observational studies have found that such thermally induced mesoscale circulation may contribute to the triggering and development of convective clouds. In the western United States, extensive areas of irrigated farmland are surrounded by hot, dry surfaces, such as a steppe. Substantial gradients of sensible heating in the horizontal direction lead to a "farm breeze" circulation from the cooler agricultural area to the warmer steppes found at Boardman, Oregon. These thermally forced circulations may trigger convection by the related convergence and updraft motion under favorable atmospheric conditions. The role of vegetative covering in convective motion is investigated using a mesoscale numerical model. Two- and three-dimensional simulations are described. The effects of atmospheric stability, moisture in the lower atmosphere, moisture in the upper atmosphere, and horizontal heating scale on thermally induced clouds are studied. The horizontal scale of inhomogeneity

is also studied using the two-dimensional model. Finally, a realistic vegetation distribution similar to that of the Boardman Regional Flux Experiment is used in the three-dimensional simulations.

24487 (CONF-940277–, pp. 193-197) **The effects of arctic stratus clouds on the solar energy budget in the atmosphere-sea ice-ocean system.** Jin, Z. (Univ. of Alaska, Fairbanks, AK (United States)); Stamnes, K.; Zak, B.D. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

This article describes a comprehensive radiative transfer model pertinent to the atmosphere-sea ice-ocean system. The main features of the model include: The atmosphere, sea ice, and ocean each represented by a sufficient number of layers to resolve the change in the optical properties of each stratum; An appropriate quadrature structure to take into account the total reflection at the air-ice or air-water interface, as well as to solve the radiative transfer equation in the coupled system consistently; Provision for a different number of streams (quadrature points) in the atmosphere, ice, and ocean, chosen based on the optical properties in each stratum and the computational accuracy method.

24488 (CONF-940277–, pp. 199-201) **Development of a hybrid cloud parameterization for general circulation models.** Kao, C.Y.J. (Los Alamos National Lab., NM (United States)); Kristjansson, J.E.; Langley, D.L. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

We have developed a cloud package with state-of-the-art physical schemes that can parameterize low-level stratus or stratocumulus, penetrative cumulus, and high-level cirrus. Such parameterizations will improve cloud simulations in general circulation models (GCMs). The principal tool in this development comprises the physically based Arakawa-Schubert scheme for convective clouds and the Sundqvist scheme for layered, nonconvective clouds. The term "hybrid" addresses the fact that the generation of high-attitude layered clouds can be associated with preexisting convective clouds. Overall, the cloud parameterization package developed should better determine cloud heating and drying effects in the thermodynamic budget, realistic precipitation patterns, cloud coverage and liquid/ice water content for radiation purposes, and the cloud-induced transport and turbulent diffusion for atmospheric trace gases.

24489 (CONF-940277–, pp. 203-206) **Atmospheric emitted radiance interferometer data analysis methods.** Knuteson, R.O. (Univ. of Wisconsin, Madison, WI (United States)); Smith, W.L.; Ackerman, S.A.; Revercomb, H.E.; Woolf, H.; Howell, H. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Data from the Atmospheric Emitted Radiance Interferometer (AERI) have been analyzed for the Atmospheric Radiation Measurement (ARM) Program's Fourier Transform Data Analysis Tools science team project under the direction of William L. Smith of the University of Wisconsin-Madison. The data consist of observations of the downwelling infrared emission at the surface from gaseous atmospheric constituents and from cloud and particulate aerosols. The observations are at 0.5 cm-1 spectral resolution over the spectral range from 500 to 3000 cm-1. Observations from the Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) have been made with an AERI prototype since March 1993. A small sample of the data collected by the AERI at the SGP CART site is given. These CART observations, combined with data collected during other field experiments, have been used to develop techniques for extracting valuable information from the infrared spectra. The science objectives of this data analysis include (1) addressing issues in radiative transfer modeling, (2) modeling cloud microphysical properties, (3) inferring cloud emissivity and reflectivity, (4) classifying spectral content, and (5) retrieving boundary layer vertical profiles of atmospheric temperature and water vapor.

24490 (CONF-940277–, pp. 207-210) **Evaluation of two radiative parameterizations using a three-dimensional large-eddy simulation microphysical model.** Kogan, Y.L. (Univ. of Oklahoma, Norman, OK (United States)); Kogan, Z.N.; Lilly, D.K.; Khairoutdinov, M.F. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Stratocumulus clouds in the marine boundary layer exert a tremendous impact on the planetary radiation balance because of their persistence and large cover. Even small biases in the representation of their radiative parameters can produce large errors in the simulated planetary radiation balance. General circulation models (GCMs) and climate models most commonly use two parameterizations of cloud optical depth. The first employs as input parameters the climatological or in some other way averaged cloud droplet effective radius and liquid water path. The second concerns droplet concentration, mean droplet radius and cloud geometrical thickness. Both parameterizations are obtained from a general theoretical expression for cloud optical depth. This paper contrasts these two parameterizations with the general theoretical definition, using a set of cloud drop distribution functions generated by the CIMMS three-dimensional large-eddy simulation (LES) stratocumulus cloud microphysical model.

24491 (CONF-940277–, pp. 211) **Parameterization of thin mid-level stratiform clouds.** Krueger, S.K. (Univ. of Utah, Salt Lake City, UT (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Thin mid-level stratiform clouds have received little attention from either modelers or observational programs, yet these clouds cover large portions of the earth and significantly affect the radiation fields.The ARM/CART program offers an unprecedented opportunity to greatly improve our ability to parameterize the radiative effects of these important clouds in climate models. The authors plan to develop and test a physically based parameterization for altocumulus layers for use in GCMs.

24492 (CONF-940277–, pp. 213-215) **Long-pathlength infrared absorption measurements in the 8- to 14-μm atmospheric window: Self-broadening coefficient data.** Kulp, T.J. (Lawrence Livermore National Lab., CA (United States)); Shinn, J. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The accurate characterization of the latent infrared (IR) absorption in the atmospheric window regions continues to be an area of research interest for the global climate modeling community. In the window between 8 and 14 μm, this absorption can be attributed primarily to water vapor. It consists of (1) weak lines originating from the edge of the water vapor pure rotational band (at low wavenumbers) and the trailing P-branch of the ν_2 rovibrational band (at the high-wavenumber boundary of the window); and (2) the water vapor continuum absorption. The goal of our project has been to improve our quantitative and physical understanding of both of these absorption processes. Specifically, our immediate

aims are to fill gaps in the experimental radiative transfer databases pertaining to the line parameters (i.e., line intensities and broadening coefficients) and to the self- and foreign-broadened water vapor continuum. To accomplish our goals, we have made long-pathlength absorption measurements using a Fourier transform infrared spectrometer (FTIR) (for the continuum and line measurements, at low resolution) and a tunable diode laser absorption spectrometer (TDLAS) (for the line measurements, at high resolution). These measurements were made on gas samples contained in a 400-m maximum pathlength Horn Pimentel multipass cell designed and constructed for this project.

24493 (CONF-940277–, pp. 223-226) **The effects of radiative transfer on low-level cyclogenesis.** Leach, M.J. (North Carolina State Univ., Raleigh, NC (United States)); Raman, S. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Many investigators have documented the role that thermodynamic forcing due to radiative flux divergence plays in the enhancement or generation of circulation. Most of these studies involve large-scale systems, small-scale systems such as thunderstorms, and squall lines. The generation of circulation on large scales results from the creation of divergence in the upper troposphere and the maintenance of low-level potentially unstable air, and the maintenance of baroclinicity throughout the atmosphere. On smaller scales, radiative flux divergence acts similarly. In the thunderstorms and squall lines, the radiative forcing acts as a pump, increasing the divergence at the top of the storm systems and increasing the updraft velocity and the intensity of inflow at mid-levels in the storm systems. Other researchers have examined the role of surface processes and low-level baroclinicity in east coast cyclogenesis. In this paper, we examine the interactive role that radiative flux divergence, clouds, and surface processes play in low-level cyclogenesis and the creation or maintenance of the boundary layer baroclinicity.

24494 (CONF-940277–, pp. 227-231) **Design of the aerosol sampling manifold for the Southern Great Plains site.** Leifer, R. (Dept. of Energy, New York, NY (United States)); Knuth, R.H.; Guggenheim, S.F.; Lee, H.N. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

To meet the needs of the ARM program, the Environmental Measurements Laboratory (EML) has the responsibility to establish a surface aerosol measurements program at the Southern Great Plains (SGP) site in Lamont, OK. At the present time, EML has scheduled installation of five instruments at SGP: a single wavelength nephelometer, an optical particle counter (OPC), a condensation particle counter (CPC), an optical absorption monitor (OAM), and an ozone monitor. ARM's operating protocol requires that all the observational data be placed online and sent to the main computer facility in real time. EML currently maintains a computer file containing back trajectory (BT) analyses for the SGP site. These trajectories are used to characterize air mass types as they pass over the site. EML is continuing to calculate and store the resulting trajectory analyses for future use by the ARM science team.

24495 (CONF-940277–, pp. 233-236) **Single-column data assimilation for the Atmospheric Radiation Measurement Program.** Louis, J.F. (Atmospheric and Environmental Research, Inc., Cambridge, MA (United States)); Zivkovic, M. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The goal of this work is to develop a data assimilation system that will use as much of the ARM data as possible and will provide a continuous description of the atmosphere over the CART site. This would be useful for initializing and validating single-column models. The authors use a variational assimilation method. The analysis is defined as the state of the atmosphere which, over a given analysis period, is closest to the observations, weakly constrained by the equations of a model. A weak constraint means that the analyzed state obeys modified model equations, to which terms accounting for the model errors have been added. These added terms are the control variables in minimizing the difference between the model simulation and the observations.

24496 (CONF-940277–, pp. 237-240) **Sensitivity of cirrus cloud radiative properties to ice crystal size and shape in general circulation model simulations.** Mitchell, D.L. (Desert Research Institute, Reno, NV (United States)); Kristjansson, J.E.; Newman, M.J. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. Grant NA36GPO278. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Recent research has shown that the radiative properties of cirrus clouds (i.e., optical depth, albedo, emissivity) depend on the shapes and sizes of ice crystals. For instance, the cloud albedo may vary by a factor of two, depending on whether hexagonal columns or bullet rosette ice crystals are assumed for a given ice water path (IWP). This variance occurs primarily because, at sizes characteristic of cirrus clouds, bullet rosettes have less mass than columns of the same size. However, their projected areas may be comparable. Thus, for a given IWP and mean cloud ice particle size, the optical depth will be considerably greater for rosettes, since many more rosettes are required to account for the IWP than are columns. The same could be said of hexagonal plates and columns, with plates exhibiting the greater optical depth. Satellite information suggests that the albedos of tropical cirrus clouds are greater than those of midlatitude cirrus, with albedos as high as 60%-80%. The reasons for this are not understood, but might be attributed in part to differences in ice particle size and shape. For instance, in the tropical western Pacific, ice crystal size distributions in cirrus near the tropopause exhibited median mass dimensions (D_m around 30 μm) and contained planar polycrystals. Very small ice crystals (typically 10 μm, often ranging from about 2 μm - 100 μm) of indeterminate shape were sampled in anvil cirrus by an ice particle replicator in this region during the Tropical Ocean Global Atmosphere (TOGA) Coupled Ocean Atmosphere Response Experiment (COARE). If fewer columnar ice crystals were present in tropical versus midlatitude cirrus and/or sizes were smaller, tropical cirrus should exhibit greater size distribution projected area, producing greater optical depth, albedo, and emissivity for the same IWP. Smaller crystal sizes would also promote higher albedos via enhanced backscattering.

24497 (CONF-940277–, pp. 241-242) **Solar radiance transmission interferometer observations at the Southern Great Plains Cloud and Radiation Testbed site.** Murcray, F. (Univ. of Denver, CO (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The prototype SORTI (SOlar Radiance Transmission Interferometer) has been collecting solar absorption spectra at the Cloud and Radiation Testbed site in the Southern Great Plains since January 1994. The instrument is equipped with two infrared detectors and has a maximum optical path difference of 280 cm, giving a spectral resolution of 0.0035 cm^{-1} (apodized) between 700 and 4000 cm^{-1} (2.5 μm to 14 μm). However, at full resolution, the maximum bandwidth is about 800 cm^{-1} per spectrum. A mercury-cadmium-telluride detector is used for the 700 to 2000 cm^{-1} region, and an indium antinomide detector is used for frequencies above 2000

cm^{-1}. A servo-controlled tracker brings solar radiation into the instrument. Full resolution spectra take less than 6 minutes. For the test period, the instrument is operated in two modes: full resolution in 4 bands (700-1300 cm^{-1}, 1900-2450 cm^{-1}, 2400-3100 cm^{-1}, and 4000-4250 cm^{-1}) 5 times per day; and 0.02 cm^{-1} resolution spectra in the same bands 11 times per day. The prototype instrument requires liquid nitrogen filling for the detectors and removal of the cover on the solar tracker. Otherwise, it is automatic. The site crew has been able to run the instrument and correct a few software problems. Data from the instrument are collected on a PC hard disk. We do not yet have a data ingest module, so the data are transferred to Denver via Internet for storage. Anyone interested can get the data from us, either by ftp or on floppy disks. An example of a small portion of the spectra from the afternoon of February 9 is shown; SORTI observations are presented.

24498 (CONF-940277–, pp. 243-245) **Cloud parameterizations in global climate models: The role of aerosols.** Penner, J.E. (Lawrence Livermore National Lab., CA (United States)); Chuang, C.C. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Aerosols influence warm clouds in two ways. First, they determine initial drop size distributions, thereby influencing the albedo of clouds. Second, they determine the lifetime of clouds, thereby possibly changing global cloud cover statistics. At the present time, neither effect of aerosols on clouds is included in general circulation models (GCMs). The goal of this project is to develop a global aerosol model and to couple it with the cloud/GCM model developed by Ghan so that the effects of aerosols on clouds can be treated in a realistic and validated manner. This model development will build on existing codes at Lawrence Livermore National Laboratory (LLNL) that are already able to describe some of the important aerosol types and their climate forcing. These codes will be extended to treat realistic sources of all aerosol types of importance. Having developed a global aerosol model, we will use measurements at Atmospheric Radiation Measurement (ARM) sites to validate the model in two ways. First, we will use our global aerosol model to study events of particular interest in the ARM data. This effort will allow us to check the accuracy of the model and its ability to reproduce events from particular time periods. Second, we will use the coupled model to study the climatology of aerosol and cloud microphysical predictions at ARM sites. This effort will allow us to check the accuracy of the model's predictions in reproducing a long time series of data. These comparison and tests should provide a stringent test of the model's completeness and prediction capabilities.

24499 (CONF-940277–, pp. 247-252) **Observations of tropical cirrus properties in the pilot radiation observation experiment using lidar and the CSIRO ARM filter radiometer.** Platt, C.M.R. (CSIRO, Victoria (Australia)); Young, S.A.; Manson, P.J.; Patterson, G.R. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

A narrow beam fast filter radiometer has been developed for the Atmospheric Radiation Measurement (ARM) Program. The radiometer is intended to operate alongside a lidar at ARM sites in a lidar/radiometer (LIRAD) configuration. The radiometer detects in three narrow bands at 8.62-, 10.86-, and 12.04-m central wavelengths in the atmospheric window. In addition, it has a variable field aperture that varies the radiance incident on the detector and also allows the field of view to be tailored to that of a lidar used in the LIRAD technique. The radiometer was deployed in the ARM Pilot Radiation Observation Experiment (PROBE) at Kavieng, Papua New Guinea in January-February 1993. The radiometer worked satisfactorily and appeared to be very stable. The radiometer was compared with a previous CSIRO radiometer and the improved performance of the ARM instrument was very evident. The ARM radiometer was also compared with a National Oceanic and Atmospheric Administration (NOAA) Environmental Technology Laboratories (ETL) interferometer and gave closely equivalent radiances. The LIRAD method was used at Kavieng to obtain the optical properties of cirrus clouds. Continuous observations of water vapor path obtained by the NOAA ETL microwave radiometer were employed to allow for the strong tropical water vapor absorption and emission. Cirrus cells that developed on one morning, independent of other clouds, had measured infrared emittances varying from <0.1 to 1.0.

24500 (CONF-940277–, pp. 253-257) **Single-column model and cumulus ensemble model simulations of GATE data.** Randall, D.A. (Colorado State Univ., Fort Collins, CO (United States)); Xu, K.M. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Our project for the Atmospheric Radiation Measurement (ARM) Program consists of developing and demonstrating improved cloud formation parameterizations using a single-column model (SCM), a cumulus ensemble model CEM and ARM data. These two models can be driven with large-scale forcing (e.g., vertical motion) as observed in ARM. Each model produces a field of clouds and the associated radiation and precipitation fields. The SCM does so through its physical parameterizations, while the CEM does so by directly simulating convective cloud circulations. The improved parameterizations tested in this way will be further tested and applied in the Colorado State University (CSU) general circulation model (GCM). To carry out this research plan, we need to attend to several tasks: develop improved cloudiness parameterizations, develop improvements to the CEM, with emphasis on cloud-radiation interactions, drive both models with the ARM data, transfer the improved parameterizations developed in this way to the CSU GCM. In this brief report, we mention our efforts and progress in each of these areas.

24501 (CONF-940277–, pp. 259-264) **Atmospheric emitted radiance interferometer: Status and water vapor continuum results.** Revercomb, H.E. (Univ. of Wisconsin, Madison, WI (United States)); Knuteson, R.O.; Smith, W.L.; Best, F.A.; Dedecker, R.G.; Howell, H.B. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Accurate and spectrally detailed observations of the thermal emission from radiatively important atmospheric gases, aerosols, and clouds are now being provided to the Atmospheric Radiation Measurement (ARM) database by the Atmospheric Emitted Radiance Interferometer (AERI) prototype at the Southern Great Plains Cloud and Radiation Testbed (CART) site. Spectra over the range from 520 to 3000 cm^{-1} (3 to 19 microns) with a resolution of 0.5 cm^{-1} are collected every 10 minutes. The observed spectra will be used for many diverse functions, including: identifying and eliminating absolute errors in calculated spectra for known atmospheric states; evaluating and improving cloud radiation calculations; characterizing the distribution and evolution of effective cloud radiative properties; studying the state parameter changes associated with the formation, evolution, and dissipation of clouds. Further very detailed spectral information (up to 0.003 cm^{-1}) is also being collected at CART from the Solar Radiance Transmission Interferometer (SORTI) prototype on clear days. The emission observations of the AERI and the absorption observations of the SORTI will be combined to enhance the spectroscopic and gas profiling information from each. The SORTI is discussed in the Murcray 1994 Science Team paper (this document). This paper deals exclusively with the AERI and includes a brief description of

the instrument deployment status and a recent spectroscopic result making use of AERI data. The general nature of the AERI spectra and the instrument design have been discussed in the 1993 ARM Science Team paper and in several conference publications.

24502 (CONF-940277–, pp. 263-264) **Radiation singularities, multiple scattering and diffusion in multifractal clouds.** Silas, P. (McGill Univ., Quebec (Canada)); Broesamlen, G.; Lovejoy, S.; Naud, C.; Schertzer, D.; Watson, B. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Many geophysical and atmospheric fields exhibit multifractal characteristics over wide ranges of scale. These findings motivate a study of transport phenomena in multifractal media, particularly diffusion. As we study the diffusion properties of one-dimensional universal multifractal resistivity fields, a relation for the diffusion exponent d(sub w) is derived and is found to depend only on K(-1), the value of the moment scaling function K(q) of the resistivity field for the q = -1 order statistical moment. This relation is subsequently verified through Monte Carlo simulations of diffusion on these systems. The study of radiative transfer in multifractal clouds is of great interest, an important application being to global climate models. In this work, we develop a formalism analogous to the multifractal singularity formalism for understanding photon scattering statistics in radiative transfer in lognormal universal multifractals, and test the results numerically.

24503 (CONF-940277–, pp. 265-274) **Warm pool physics in a coupled general circulation model.** Schneider, N. (Univ. of California, San Diego, La Jolla, CA (United States)); Barnett, T.P.; Latif, M.; Stockdale, T. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The warmest waters found in the open ocean are situated in the equatorial Indo-Pacific Ocean and are generally referred to as the warm pool (WP). Much could be said about the important climate processes that occur in the warm pool (e.g., World Climate Research Programme 1990), but perhaps it suffices to demonstrate the critical nature of this area by noting that the international scientific community recently concluded a large field program to elucidate the physics of the west Pacific warm pool. As part of the modeling effort of the Atmospheric Radiation Measurement (ARM) Program, we examine in assimulation with a coupled ocean-atmosphere general circulation model (CGCM) the seasonal migration of the warm pool, its heat budget, and its relationship with radiation and clouds. The model, developed at the Max Planck Institute of Meteorology, Hamburg, couples state-of-the-art atmospheric and ocean GCM to reproduce today's climate without flux correction.

24504 (CONF-940277–, pp. 275-277) **Triggering of boundary layer cumulus clouds over a heterogeneous surface.** Schrieber, K. (Univ. of Wisconsin, Madison, WI (United States)); Stull, R.; Zhang, Q. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract FG02-92ER61361. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Complex multimodal joint frequency distributions of LCL height versus θ_v in surface-layer air over a large heterogeneous surface area are modeled as the superposition of simpler mono-modal distributions. These simpler distributions, which apply to quasi-homogeneous subdomains, are approximated with bivariate distribution models. The shape of each of these modeled distributions depends on variations of the Bowen ratio and heat input forcings. These forcings are a function of the landscape, insolation, surface albedo, cloud-shading, soil moisture, and other factors that either are known as imposed boundary conditions or can be resolved or parameterized on the coarse grid scale of a global climate forecast model (GCM). This approach is motivated by the need to forecast subgrid-scale boundary-layer cumulus clouds in GCMs and in one-dimensional (single column) forecast models. The full distribution function, formed as a composite from the simpler models, can be combined with mean virtual temperature sounding information to forecast cloud onset time, cloud coverage, cloud base and heights, and cloud size distributions of an ensemble of subgrid clouds. Thus, land-use inventories or similar satellite-based observations of relative landscape amounts have the potential to be combined with distribution parameterizations such as those explored to forecast subgrid clouds. As a case study, we have analyzed aircraft data from the Hydrologic Atmospheric Pilot Experiment (HAPEX) field experiment in southwest France, which was designed to answer basic questions about GCM subgrid modeling within a horizontal grid area 100 km on a side. For this data set, we found that bivariate range-cut Gaussian or pq distribution models work equally well to approximate the simpler mono-modal distributions within quasi homogeneous subdomains.

24505 (CONF-940277–, pp. 279-282) **Millimeter-wavelength cloud measurements taken with the polarimetric cloud profiling radar system.** Sekelsky, S.M. (Univ. of Massachusetts, Amherst, MA (United States)); McIntosh, R.E. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

This paper reviews hardware for the Cloud Profiling Radar System (CPRS) and presents dual-frequency measurements that illustrate how CPRS reflectivity data may be used for cloud particle sizing. Reflectivity data show Mie scattering in the ice region, melting layer, and rain region of a stratiform cloud with light, broken precipitation. Measurements of Ze_{95} and Ze_{33} with and without precipitation show that differential attenuation is low and does not dominate the reflectivity differences. A theoretical model of Ze_{95} - Ze_{33} versus mean particle diameter for monodisperse and Gaussian size distributions of water droplets is presented to illustrate the concept of particle sizing using dual-wavelength reflectivity data.

24506 (CONF-940277–, pp. 285-286) **A one-dimensional radiative convective model with detailed cloud microphysics.** Simmons, J. (Univ. of Alaska, Fairbanks, AK (United States)); Lie-Svendsen, O.; Stamnes, K. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The Arctic is a key element in determining the radiation budget of the earth. Within the polar regions, the net radiation (incoming solar radiation minus outgoing infrared radiation) is negative. To understand the role this energy deficit plays in the overall radiation budget, one must examine the prevalent atmospheric features of the Arctic. One such feature is a persistent layer of low-altitude, stratiform clouds found over the central Arctic predominantly from April to September. These Arctic stratus clouds (ASC) modulate the earth's radiation budget by contributing to the vertical transport of heat. It is, therefore, crucial to understand the radiative properties of Arctic stratus clouds. We believe that the radiative properties of ASC are strongly coupled with their cloud microphysics. Our aim is to develop a model that will determine if this coupling is sufficient to describe the observed characteristic properties, such as lifetime and the multi-layered structure, of ASC. In addition, we hope to provide useful input to measurement programs at the Atmospheric Radiation Measurement Program's North Slope of Alaska site by isolating the measurable parameters that influence the overall radiative properties of ASC. Several features of ASC have been integrated directly into the one-dimensional model currently being developed. Generally, ASC cover large areas and exhibit reasonable horizontal homogeneity but extensive vertical inhomogeneities.

Therefore, in our model, we have assumed radiative processes are important in determining vertical structure while not considering horizontal transport. In addition, ASC occur in defined, multi-layered structures. This feature of the ASC, in conjunction with their horizontal homogeneity, justifies the use of radiative transfer theory for plane-parallel geometry with multiple scattering. Finally, ASC are generally long-lived and precipitate little during their lifetimes.

24507 (CONF-940277–, pp. 287-290) **Ground-based radiometric observations of atmospheric water for climate research.** Snider, J.B. (National Oceanic and Atmospheric Administration, Boulder, CO (United States)); Hazen, D.A.; Francavilla, A.J.; Madsen, W.B.; Jacobson, M.D. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Surface-based microwave and infrared radiometers have been employed by the National Oceanic and Atmospheric Administration's Environmental Technology Laboratory (NOAA/ETL) in climate research since 1987. The ability of these systems to operate continuously and unattended for extended periods of time has provided significant new information on atmospheric water vapor and cloud liquid. These data are being employed to improve our understanding of cloud-radiation feedback mechanisms, an understanding that is fundamental to accurate prediction of global warming. In addition to collecting data on the relation between atmospheric water substance, atmospheric transmission and cloud albedo, the radiometric observations provide groundtruth for validation and calibration of satellite measurements of water vapor and liquid water. This application is extremely important since accurate satellite monitoring of the earth is required to evaluate possible atmospheric changes that may influence global climate.

24508 (CONF-940277–, pp. 291-295) **Diagnostic analysis of cloud radiative properties.** Somerville, R.C.J. (Univ. of California, San Diego, La Jolla, CA (United States)); Iacobellis, S.F. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract FG03-90ER61061. Grant ATM91-14109; Grant NAG5-236; Grant NAG5-2238; Grant NA90AA From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

A current dilemma of climate modeling is that general circulation model (GCM) results are extremely sensitive to parameterizations of certain poorly understood physical processes, most notably cloud-radiation interactions. As a result, models with different plausible parameterizations give very different results. Yet, we have no firm basis for knowing which parameterization is more nearly "correct." It is true that parameterizations are not the only shortcoming of GCMs. Our current ability to create models that will adequately simulate today's climate and predict its evolution is limited by several factors, not just by one. Some of these factors are technical, such as a lack of computer power. Nevertheless, the most critical need is for an improved physical understanding of the key physical processes. Until these processes are much better understood and until this understanding is incorporated in our models, the model results will always be subject to major uncertainties. Reducing these uncertainties so that we can have confidence in the reliability and accuracy of climate forecasts requires focused research on climate processes. Of the many physical processes involved in climate simulations, feedback from cloud-radiation interactions is currently thought to be the largest single source of uncertainty. For this reason, the Committee on Earth and Environmental Sciences continues to rank the role of clouds as the highest science priority for the U.S. Global Change Research Program. As an example of the importance of cloud-radiation feedbacks, it is noteworthy that the sensitivity of model-simulated climates to changes in atmospheric carbon dioxide concentration has undergone major fluctuations in recent years. The equilibrium global average surface temperature change in response to a carbon dioxide doubling, based on GCM results from models developed in the mid-1970s, was typically between 2°C and 3°C.

24509 (CONF-940277–, pp. 297-299) **Objective analysis schemes to monitor atmospheric radiation measurement data in near real-time.** Splitt, M. (Univ. of Oklahoma, Norman, OK (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Recent work in this area by Charles Wade (1987) lays out the groundwork for monitoring data quality for projects with large networks of instruments such as the Atmospheric Radiation Measurement (ARM) Program. Wade generated objectively analyzed fields of meteorological variables (temperature, pressure, humidity, and wind) and then compared the objectively analyzed value at the sensor location with the value produced by the sensor. Wade used a Barne's objective analysis scheme to produce objective data values for a given meteorological variable (q) in two-dimensional space. The objectively analyzed value should be comparable to the actual sensor value if: (1) the variable q is appropriate for this type of objective analysis; (2) the data quality of the sensors is good; and (3) there are a significant number of sensors on which to base the objective analysis. If conditions 1 and 3 are satisfied, the objective values can be compared with the actual values to provide an estimate of the data quality.

24510 (CONF-940277–, pp. 301-304) **Solar heating in the upper ocean.** Stamnes, K. (Univ. of Alaska, Fairbanks, AK (United States)); Jin, Z. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

A discrete ordinate method has been developed to solve the radiative transfer problem in nonuniformly refracting layered media such as the atmosphere-ocean system. In the radiative transfer model for the atmosphere-ocean system the essential points are: In the ocean, region I is the total reflection region and region II is the refraction region. The downward radiation distributed over 2π steradians in the atmosphere is restricted to a cone (less than 27π steradians) upon refraction across the interface into the ocean. Photons in region 11 of the ocean may be scattered into region 1. Note, however, that photons in region I of the ocean cannot reach the atmosphere directly and vice versa. The atmosphere and region I "communicate" through the scattering process between region I and region II in the ocean. Appropriate quadrature points (streams) and weights have been chosen for the interface continuity relations. To take into account the region of total reflection in the ocean, separate angular quadrature points are adopted in addition to those used in the atmosphere and the refractive region of the sea ice and ocean. This quadrature specification automatically accounts for the refraction and reflection at the air-sea interface and solves the radiative transfer equation in the coupled system consistently. The total number of quadrature points (streams) chosen for each stratum is based on the optical properties and the accuracy required.

24511 (CONF-940277–, pp. 305-311) **Ground- and space-based humidity profiling in a cloudy atmosphere with strong elevated temperature inversion.** Stankov, B.B. (National Oceanic and Atmospheric Administration, Boulder, CO (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

It has been demonstrated that improved atmospheric profiles of temperature and humidity result when proper combinations of ground-based and space-based data from multiple platforms and sensors are used as a first guess for temperature and humidity in

a physical retrieval algorithm. A wide range of platforms and sensors were used. The retrieval algorithm was provided by the International TOVS Processing Package (ITPP). In this ITPP method, all first-guess profiles are based on statistical regression analysis. It has been also demonstrated that accurate profiles of humidity and liquid water density can be obtained during cloudy conditions by combining data from ground-based remote sensors only, in the iterative retrieval scheme, provided that the vertical cloud distribution is known. In this study, we show that in more complex meteorological situations, both methods described above can be used sequentially to obtain the humidity profile that represents the thermodynamic properties of the atmosphere. On February 7 a cold front was approaching Platteville, Colorado, causing a 15°C, strong elevated inversion at 100 m above ground. The microwave radiometer showed 0.56 mm of liquid and 0.507 cm of vapor. This more complex type of meteorological situation was not encountered in either of the two previous studies. Using only the ITPP method to retrieve the temperature and humidity profiles gives a good temperature profile; however, the retrieved humidity profile shows some serious problems. For instance, it does not show that the air inside the cloud layer is saturated. Thus, we use the ground-based method to retrieve a humidity profile and then use this as a first guess in the ITPP method. The humidity profile obtained using this combined method is a significant improvement and represents the thermodynamic properties of the atmosphere very well.

24512 (CONF-940277–, pp. 313) **Characterization of the radiative properties of inhomogeneous clouds.** Stephens, G.L. (Colorado State Univ., Ft. Collins, CO (United States)); Gabriel, P.M.; Evans, K.F.; Stackhouse, P. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

One of the major sources of uncertainty in climate-based studies is related to clouds and their influence on the radiative transfer. Two broad issues are of relevance to this problem: (1) the influence of clouds on broadband radiative transfer and thus on cloud energetics and (2) the influence of clouds on spectral transfer and thus on remote sensing applications. The work described addresses key aspects of both these issues. One of the key issues in parameterizing cloud radiative processes is to account for the subgrid scale variability. A common approach for incorporating horizontal cloud inhomogeneity in radiative transfer calculations is the use of cloud fraction. We have attempted to determine the limitations of this approach by performing radiative transfer calculations applied to inhomogeneous clouds embedded in two dimensions. For solar radiation, use of cloud fraction leads to non-unique domain averaged albedos; exhibiting significant variations. We have developed new approximate methods to account for the sub-grid scale variability of clouds on the radiative transfer. This approximate method is based on a first order closure technique. Exploiting the translational invariance of the equation of transfer leads to a one-dimensional, plane-parallel-like equation with a modified source term. This approach results in computational speeds exceeding that of the independent pixel approximation and improved accuracy over the latter as determined by numerical solutions of the two-dimensional transfer equation.

24513 (CONF-940277–, pp. 315-316) **Monte Carlo simulation of longwave fluxes through broken scattering cloud fields.** Takara, E.E. (Univ. of Maryland, College Park, MD (United States)); Ellingson, R.G. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The importance of cloud fields on the radiative energy budget is well known. For the sake of computational efficiency, cloud fields in general circulation models (GCMs) are approximated as flat black plates. This neglect of cloud geometry and transmissivity can lead to significant error in predicting radiative transfer. Increasing the sophistication of cloud models in GCMs has become a priority. Proper modeling of clouds requires that both their geometry and optical properties be taken into account. Modeling clouds as flat plates neglects the geometry. It has been well documented that the sides can have a significant effect. Scattering plays a significant role in the visible portion of the spectrum. The parameterized single scattering albedo for a cloud in the visible is above 0.99. As a result, most of the work on scatter in cloud fields has been done in the shortwave regime. The parameterized cloud single scattering albedos in the long wave ranges from 0.5 to 0.75.

24514 (CONF-940277–, pp. 317-323) **Use of cloud and radiation testbed measurements to evaluate cloud cover and convective parameterizations.** Walcek, C.J. (State Univ. of New York, Albany, NY (United States)); Hu, Q. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

We have used temperature and humidity soundings and radiation measurements from the Atmospheric Radiation Measurement (ARM) Cloud and Radiation Testbed (CART) site in northern Oklahoma to evaluate an improved cloud cover algorithm. We have also used a new single-column model cumulus parameterization to estimate convective heating and moistening tendencies at the CART site. Our earlier analysis of cloud cover showed that relatively dry atmospheres contain small cloud amounts. We have found numerous periods during 1993 where maximum relative humidities within any layer of the atmosphere over the CART site are well below 60-80%, yet clouds are clearly reducing shortwave irradiance measured by a rotating shadowband radiometer. These ARM measurements support our earlier findings that most current climate models probably underestimate cloud coverage when relative humidities fall below the threshold humidities where clear skies are assumed. We have applied a "detraining-plume" model of cumulus convection to the June 1993 intensive observation period (16-25 June 1993). This model was previously verified with GARP Atlantic Tropical Experiment (GATE) measurements. During the June intensive observing period (IOP), relative humidities over the CART site are typically 20% less than tropical Atlantic GATE relative humidities. Our convective model calculates that evaporation of convectively induced cloud and rainwater plays a much more important role in the heating and moistening convective tendencies at the drier CART location. In particular, we predict that considerable cooling and moistening in the lower troposphere should occur due to the evaporation of convectively initiated precipitation.

24515 (CONF-940277–, pp. 325-331) **Treatment of cloud radiative effects in general circulation models.** Wang, W.C. (State Univ. of New York, Albany, NY (United States)); Dudek, M.P.; Liang, X.Z.; Ding, M.; Zhu, L.; Joseph, E.; Cox, S. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

We participate in the Atmospheric Radiation Measurement (ARM) Program with two objectives: (1) to improve the general circulation model (GCM) cloud/radiation treatment with focus on cloud overlapping and the cloud optical properties; and (2) to study the effects of cloud/radiation-climate interaction on climate simulations. This report summarizes project progress from March 1993 to March 1994. During this period, four graduate students continue to participate in the research.

24516 (CONF-940277–, pp. 333-335) **Preliminary analysis of ground-based microwave and infrared radiance observations during the Pilot Radiation OBservation Experiment.** Westwater, E.R. (National Oceanic and Atmospheric Administration, Boulder, CO (United States)); Han, Y.; Churnside, J.H.; Snider, J.B. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation

measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

During Phase Two of the Pilot Radiation OBservation Experiment (PROBE) held in Kavieng, Papua New Guinea, the National Oceanic and Atmospheric Administration's Environmental Technology Laboratory (ETL) operated both microwave and infrared radiometers. Phase Two lasted from January 6 to February 28, 1993. The dramatic differences in the water vapor environment between the tropics and mid-latitudes were illustrated by Westwater et al. (1994) who presented PROBE data as well as additional data that were taken during the 1991 First ISCCP Regional Experiment (FIRE) 11 experiment in Coffeyville, Kansas. We present an analysis of microwave data and a preliminary analysis of infrared data obtained during PROBE.

24517 (CONF-940277–, pp. 337-340) **Ship-based measurements of cloud optical properties during the Atlantic Stratocumulus Transition Experiment.** White, A.B. (Univ. of Colorado, Boulder, CO (United States)); Fairall, C.W. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The Atlantic Stratocumulus Transition Experiment (ASTEX), conducted in June 1992, was designed with the broad goal of improving the dynamical, radiative, and microphysical models of marine boundary layer (MBL) clouds. This goal was pursued by combining measurements from a number of different platforms including aircraft, satellites, ships, and islands. In this paper, we examine the optical properties of MBL clouds using measurements taken on the NOAA research vessel Malcom Baldridge. We seek the relationship between optical depth and liquid water because this relationship is used to parameterize the optical properties of clouds in many global climate models (GCMs). We compare our results with the results obtained from two other marine cloud studies.

24518 (CONF-940277–, pp. 341-345) **Climate zones for maritime clouds.** White, A.B. (Univ. of Colorado, Boulder, CO (United States)); Ruffieux, D.; Fairall, C.W. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

In this paper we use a commercially available lidar ceilometer to investigate how the basic structure of marine boundary-layer clouds varies for four different marine climate regimes. We obtained most of the data used in this analysis from ship-based ceilometer measurements recorded during several different atmospheric and oceanographic field programs conducted in the Atlantic and Pacific oceans. For comparison, we show the results obtained at a mid-latitude continental location and at an ice camp on the Arctic ice shelf. For each analyzed case, we use an extended time series to generate meaningful cloud base and cloud fraction statistics. The Vaisala CT 12K ceilometer uses a GaAs diode laser to produce short (150 ns), high-intensity pulses of infrared radiation (904 nm wavelength). The return signals from a large number of consecutive pulses are coherently summed to boost the signal-to-noise ratio. Each resulting 30-s profile of backscattered power (15-m resolution) is analyzed to detect cloud layers using a specified cloud detection limit. In addition to measurements of cloud base, the ceilometer can also provide information on cloud fraction using a time series of the "cloud" or " no cloud" status reported in the 30-s data.

24519 (CONF-940277–, pp. 347-349) **Radiometric sounding system.** Whiteman, C.D. (Pacific Northwest Lab., Richland, WA (United States)); Anderson, G.A.; Alzheimer, J.M.; Shaw, W.J. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. DOE Contract AC06-76RL01830. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Vertical profiles of solar and terrestrial radiative fluxes are key research needs for global climate change research. These fluxes are expected to change as radiatively active trace gases are emitted to the earth's atmosphere as a consequence of energy production and industrial and other human activities. Models suggest that changes in the concentration of such gases will lead to radiative flux divergences that will produce global warming of the earth's atmosphere. Direct measurements of the vertical variation of solar and terrestrial radiative fluxes that lead to these flux divergences have been largely unavailable because of the expense of making such measurements from airplanes. These measurements are needed to improve existing atmospheric radiative transfer models, especially under the cloudy conditions where the models have not been adequately tested. A tethered-balloon-borne Radiometric Sounding System has been developed at Pacific Northwest Laboratory to provide an inexpensive means of making routine vertical soundings of radiative fluxes in the earth's atmospheric boundary layer to altitudes up to 1500 m above ground level. Such vertical soundings would supplement measurements being made from aircraft and towers. The key technical challenge in the design of the Radiometric Sounding System is to develop a means of keeping the radiometers horizontal while the balloon ascends and descends in a turbulent atmospheric environment. This problem has been addressed by stabilizing a triangular radiometer-carrying platform that is carried on the tetherline of a balloon sounding system. The platform, carried 30 m or more below the balloon to reduce the balloon's effect on the radiometric measurements, is leveled by two automatic control loops that activate motors, gears and pulleys when the platform is off-level. The sensitivity of the automatic control loops to oscillatory motions of various frequencies and amplitudes can be adjusted using filters.

24520 (CONF-940277–, pp. 351) **Use of a cloud ensemble model to develop cloudiness parameterizations.** Xu, K.M. (Colorado State Univ., Ft. Collins, CO (United States)); Randall, D.A. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to use a cloud ensemble model (CEM) as a tool for developing a cloudiness parameterization for use in climate models. CEM is a cloud-resolving model that is able to simulate an ensemble of clouds under given large-scale conditions. It can also provide detailed, statistical properties of clouds, information that cannot be obtained from observations. Several simulations have been performed with (1) typically observed large-scale conditions (e.g., large-scale advective cooling and moistening rates and large-scale pressure gradient forces) in the tropics; and (2) during the Atlantic Stratocumulus Transition EXperiment (ASTEX), using the University of California at Los Angeles CEM. Xu and Randall (1994) provide details of the simulations of tropical cloud clusters. The results from the ASTEX simulation are very preliminary. The main finding is that the amounts of stratiform cloud are highly correlated with cloud water+ice mixing ratio in both cloud regimes. The stratiform cloud amounts are somewhat correlated with the relative humidity (RH), too. The relationship between stratiform cloud amount and cloud water+ice mixing ratio does not depend upon the grid size of climate models. The scatter around the regression line is, however, slightly larger for smaller grid size. The large variation of relative humidity in smaller grid sizes is responsible for the scatter. Thus, a more accurate estimate of stratiform cloud amount must also include its dependency on RH.

24521 (CONF-940277–, pp. 353-355) **Single-column model for atmospheric radiation measurement sites: Model development and sensitivity test.** Xu, Q. (Univ. of Oklahoma, Norman, OK (United States)); Dong, M. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr

1995. Contract NA90-RAH00078; Contract 144880-A-Q1. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

A single-column model (SCM) is constructed by extracting the physical subroutines from the community climate model (CCMI) of the National Center for Atmospheric Research. Using observational data obtained from the Oklahoma Atmospheric Radiation Measurement (ARM) site and the National Weather Services, this SCM will perform diagnostic studies of radiation and cloud parameterizations. So far, the model has been tested with simulated data generated by CCM1 global runs. The global runs provide the SCM with initial and lateral boundary conditions that represent the Oklahoma ARM site. The preliminary results can be summarized as follows: the SCM can produce nearly the same results as the CCM1 if the lateral boundary conditions are precisely given from the spectral forms of representation of boundary fluxes; the SCM results are moderately sensitive to noise in the lateral boundary conditions. The SCM simulated temperature can (or cannot) closely follow the CCM1 global run if the noise in the lateral boundary fluxes is below (or above) 10% of the single level. The representativeness of the lateral boundary conditions seems crucial for the SCM simulations. When the advection term is calculated by using the central finite difference scheme from the gridded (instead of spectral) data produced by the CCM1 run, the SCM simulated temperature can differ significantly from that of the CCM1 global run.

24522 (CONF-940277–, pp. 357-360) **The impacts of data error and model resolution on the result of variational data assimilation.** Yang, S. (Univ. of Oklahoma, Norman, OK (United States)); Xu, Q. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. Contract NA90-RAH00078; Contract 144880-A-Q1. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The representativeness and accuracy of the measurements or estimates of the lateral boundary fluxes and surface fluxes are crucial for the single-column model and budget studies of climatic variables over Atmospheric Radiation Measurement (ARM) sites. Since the direct measurements of these fluxes have limited resolution, it is desirable to use high-resolution Doppler-radar data to retrieve the three-dimensional wind and temperature fields and improve the representativeness and accuracy of the estimated fluxes. To this end, a number of techniques of variational data assimilation (VDA) are currently being developed. This paper is intended to address the following specific issues: How is the retrieval error affected by the observational error? Could the observational error cause a bias in the retrieval? Does the retrieval error depend on the model grid resolution and how?

24523 (CONF-940277–, pp. 361-365) **Comparison between general circulation model simulation and central equatorial Pacific experiment measurements.** Zhang, G.J. (Univ. of California, San Diego, La Jolla, CA (United States)); Sherwood, S.; Barnett, T.P.; Ramanathan, V. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

A general circulation model (GCM) is a very powerful tool for understanding many climate issues. However, it must be validated using observational data in order for the model results to be credible in climate prediction. Data from the Atmospheric Radiation Measurement (ARM) Program will provide a valuable avenue for model validation. Effective use of GCMs can help to understand many important issues, such as the interaction between convection, boundary properties and surface radiative, and sensible and latent heat fluxes. To demonstrate the use of observed data for GCM validation, we compare the GCM simulation of the atmospheric fields with those from the field measurements during the Central Equatorial Pacific EXperiment (CEPEX). The CEPEX field mission was conducted from March 7 to April 6, 1993. Details of the experiment can be found in CEPEX Experiment Design (1993) and the CEPEX Operations Summary (1993). The measurements used in this study were mainly from the R/V Vickers, which cruised during the CEPEX period from about 160E to about 160W along 2S. Fifty-four soundings (including both Vaisala sondes and frostpoint hygrometer sondes) were launched during the course of the cruise. Surface data from the Tropical Ocean Global Atmosphere (TOGA) Tropical Atmosphere-Ocean (TAO) moored buoys are also used for comparison. The GCM used for this study is from the Max-Planck Institute and the University of Hamburg, Germany (ECHAM3). The simulation for the CEPEX period starts December 1, 1992. The lower boundary condition is from the interpolation of the monthly mean observed sea surface temperature (SST). The results averaged over the month from March 7 to April 6, 1993, are used for comparison with the field measurements.

24524 (CONF-940277–, pp. 367-370) **Sensitivity analysis with adjoint of radiation code.** Zivkovic, M. (Atmospheric and Environmental Research, Inc., Cambridge, MA (United States)); Louis, J.F. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The Atmospheric and Environmental Research (AER) Local Forecast and Assimilation (ALFA) model has been coupled with the NASA/Ames rapid model for radiation calculations. To provide a data assimilation system for the Atmospheric Radiation Measurement (ARM) Program, the adjoint codes of both models have been written. In addition to the data assimilation application, the adjoint can be used for sensitivity analysis applications. This paper reviews some results of a sensitivity analysis of radiative parameters in the spectral domain and within the context of a general circulation model (GCM). The adjoint equations allow a direct computation of the sensitivities of a model output to all meteorological and radiation parameters, with a single integration of the nonlinear model and the adjoint model. For example, if one is interested in knowing how sensitive the surface temperature is to the radiation parameters compared with other meteorological parameters, the response function needs to be set to surface temperature. At the end of the adjoint integration, the values of the adjoint variables corresponding to those parameters provide the requested sensitivities. Furthermore, if we know the uncertainties associated with these parameters, the accuracy of the model can be assessed. An example of such a computation is presented.

24525 (CONF-940277–, pp. 371-381) **Brightness fields of broken clouds.** Zuev, V.E. (Institute of Atmospheric Optics, Tomsk (Russian Federation)); Titov, G.A.; Kasyanov, E.I.; Zimin, D.A. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The radiation budget and brightness field of the system "atmosphere-underlying surface" are controlled, to a considerable degree, by the variety of forms and the strong space-time variability of cloud cover. The space and angle structure of the radiation fields of cloudy atmosphere together with their sensitivity to cloud variations provide an important source of information needed to formulate and solve problems of the remote optical sensing of cloudy atmosphere and of satellite meteorology, as well as for retrievals of the albedo from satellite measurements. Recent theoretical studies are largely based on the solution of the equation of radiative transfer in a plane-parallel, horizontally homogeneous cloud layer partially or completely covering the sky. However, such a simple model overlooks significant effects associated with the random geometry of the cloud field and, in fact, the important role it plays in

the formation of the radiation budget and brightness fields of the cloudy atmosphere. The presence of the above limitations, as well as a variety of related unsolved problems, for instance, with the interpretation of satellite data, has recently stimulated the development of the radiative transfer theory in stochastic scattering media.

24526 (CONF-940277–, pp. 383-385) **Mean fluxes of the near-infrared radiation in broken clouds.** Zuev, V.E. (Institute of Atmospheric Optics, Tomsk (Russian Federation)); Titov, G.A.; Zhuravleva, T.B.; Popov, S.Y. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Radiation codes of current general circulation models (GCMs) involve calculations of the spectrally integrated upward and downward fluxes of solar and thermal radiation at different atmospheric levels. For the visible, vertical profiles of the mean fluxes of upward and downward radiation in cumulus are studied by others. The aim of this study is to investigate the vertical profiles of the mean spectral fluxes of infrared (IR) solar radiation and the absorption in the field of cumulus clouds. The model of the atmosphere and methods for calculating the mean spectral fluxes in the near-IR spectral range are discussed in detail.

24527 (CONF-940277–, pp. 387-393) **Mean fluxes of visible solar radiation in broken clouds.** Zuev, V.E. (Institute of Atmospheric Optics, Tomsk (Russian Federation)); Titov, G.A.; Zhuravleva, T.B.; Popov, S.Y. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Generally, radiation codes for general circulation models (GCMs) include, together with other procedures, calculations of vertical profiles of upward and downward radiation fluxes which are needed to calculate radiant heat influxes. These last radiative characteristics serve as an input for a number of atmospheric processes predicted from GCMs, e.g., the equation of radiant heat influxes is sometimes a starting point for modeling the formation and evolution of cloud fields; the equation of heat balance of the earth's surface involves solar and thermal radiation fluxes that govern the surface thermal regime; and so forth. The question of the accuracy of determinations of the upward and downward radiation fluxes at different atmospheric levels is important. Most of the present GCM codes make use of the models of plane-parallel, horizontally homogeneous atmosphere and are based computationally on solving the equation of radiative transfer using deterministic optical characteristics. In the presence of clouds partially covering the sky, flux values represent a linear combination of clear- and overcast-sky fluxes weighted by a specific value of cloud fraction. Such an approach is adequate for the stratus-clouds-only cases, when the parameter $\gamma \approx 0$ (with $\gamma = H/D$, H the cloud layer thickness, and D the mean horizontal cloud size). Under the cumulus cloud conditions ($\gamma \approx 1$), the approach can be regarded merely as a first, fairly crude approximation, recognizing that the shortwave radiative transfer is affected remarkably by the stochastic geometry of cloud fields. Mean albedo and transmission of shortwave radiation in the system "clouds-aerosol-underlying surface" are sufficiently investigated. In the present work, we raise the question about the value of the effect the cloud field random geometry has on the mean upward and downward fluxes of the visible and near-IR solar radiation throughout the atmosphere.

24528 (CONF-950226–46) **Real-time chemical analysis of aerosol particles.** Yang, M.; Whitten, W.B.; Ramsey, J.M. Oak Ridge National Lab., TN (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine; San Jose, CA (United States); 5-14 Feb 1995. Order Number DE95008971. Source: OSTI; NTIS; GPO Dep.

An important aspect of environmental atmospheric monitoring requires the characterization of airborne microparticles and aerosols. Unfortunately, traditional sample collection and handling techniques are prone to contamination and interference effects that can render an analysis invalid. These problems can be avoided by using real-time atmospheric sampling techniques followed by immediate mass spectrometric analysis. The former is achieved in these experiments via a two state differential pumping scheme that is attached directly to a commercially available quadruple ion trap mass spectrometer. Particles produced by an external particle generator enter the apparatus and immediately pass through two cw laser/fiberoptic based detectors positioned two centimeters apart. Timing electronics measure the time between detection events, estimate the particles arrival in the center of the ion trap and control the firing of a YAG laser. Ions produced when the UV laser light ablates the particle's surface are stored by the ion trap for mass analysis. Ion trap mass spectrometers have several advantages over conventional time-of-flight instruments. First, they are capable of MS/MS analysis by the collisional dissociation of a stored species, This permits complete chemical characterization of airborne samples. Second, ion traps are small and lend themselves to portable, field oriented applications.

24529 (CONF-9506191–2) **Cloud cover and type over the former USSR, 1936-83; trends derived from the RIHMI-WDC 223-station 6- and 3-hourly meteorological database.** Kaiser, D.P. (Oak Ridge National Lab., TN (United States)); Razuvaev, V.N. Oak Ridge National Lab., TN (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. international meeting on statistical climatology; Galway (Ireland); Jun 1995. Order Number DE95014285. Source: OSTI; NTIS; GPO Dep.

This paper presents trends analyses of sky cover data from the former U.S.S.R. for the period 1936-83. Observations of total cloud amount, low cloud amount, and low-, middle-, and high-cloud type from 223 stations were obtained from a database of 6- and 3-hourly meteorological observations compiled at the Research Institute of Hydrometeorological Information - World Data Centre in Obninsk, Russia. Station data were averaged over various-sized grid boxes and linear trends in seasonal mean total cloud amount, low cloud amount, frequency of occurrence of cirrus clouds, cirrus amount, and frequency of clear sky were computed for the period 1936-83.

24530 (DLR-FB–94-18) **The squall line of 21 July 1992 in Switzerland and southern Germany - a documentation.** Haase-Straub, S.P. (ed.) (Muenchen Univ. (Germany). Meteorologisches Inst.); Heimann, D. (ed.); Hauf, T. (ed.); Smith, R.K. (ed.). Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Wessling (Germany). Forschungsbereich Nachrichtentechnik und Erkundung; Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Koeln (Germany). Abt. Operative Planung. Jul 1994. 236p. Order Number DE95791278. Source: OSTI; NTIS (US Sales Only).

This volume contains scientific contributions of German and Swiss colleagues who were engaged in the case study of 21 July 1992 within the scope of the CLEOPATRA field experiment. The contributions document the meteorological situation that brought about severe storms on this day. (orig.)

24531 (DOE/ER–0650T) **Atmospheric Science Program. Summaries of research in FY 1994.** USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Jun 1995. 71p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014935. Source: OSTI; NTIS; GPO Dep.

This report provides descriptions for all projects funded by ESD under annual contracts in FY 1994. Each description contains the project's title; three-year funding history (in thousands of dollars); the contract period over which the funding applies; the name(s) of the principal investigator(s); the institution(s) conducting the projects; and the project's objectives, products, approach, and results to date (for most projects older than one year). Project descriptions are categorized within the report according to program areas: atmospheric chemistry, atmospheric dynamics, and support operations. Within these categories, the descriptions are ordered alphabetically by principal investigator. Each program area is preceded by a brief text that defines the program area, states it goals and objectives,

lists principal research questions, and identifies program managers. Appendixes provide the addresses and telephone numbers of the principal investigators and define the acronyms used.

24532 (DOE/ER/60397–7) **Detection of greenhouse-gas-induced climatic change. Progress report, July 1, 1994–July 31, 1995.** Jones, P.D.; Wigley, T.M.L. East Anglia Univ., Norwich (United Kingdom). Climatic Research Unit. 21 Jul 1995. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER60397. Order Number DE95015922. Source: OSTI; NTIS; GPO Dep.

The objective of this research is to assembly and analyze instrumental climate data and to develop and apply climate models as a basis for detecting greenhouse-gas-induced climatic change, and validation of General Circulation Models. In addition to changes due to variations in anthropogenic forcing, including greenhouse gas and aerosol concentration changes, the global climate system exhibits a high degree of internally-generated and externally-forced natural variability. To detect the anthropogenic effect, its signal must be isolated from the "noise" of this natural climatic variability. A high quality, spatially extensive data base is required to define the noise and its spatial characteristics. To facilitate this, available land and marine data bases will be updated and expanded. The data will be analyzed to determine the potential effects on climate of greenhouse gas and aerosol concentration changes and other factors. Analyses will be guided by a variety of models, from simple energy balance climate models to coupled atmosphere ocean General Circulation Models. These analyses are oriented towards obtaining early evidence of anthropogenic climatic change that would lead either to confirmation, rejection or modification of model projections, and towards the statistical validation of General Circulation Model control runs and perturbation experiments.

24533 (ENEA-RT-AMB–93-12) **Evaluation of aerosol particulate measurements based on membrane filters analysis.** Formignani, M. (ENEA, Bologna (Italy). Area Energia Ambiente e Salute); Castellani, C.M.; Tarroni, G. ENEA, Bologna (Italy). Area Energia Ambiente e Salute. Apr 1993. 37p. (In Italian). Order Number DE95789710. Source: OSTI; NTIS (US Sales Only).

The present report summarizes a study on evaluation of the uncertainty concerned with the measurement of the mass airborne concentration performed with aerosol particulate sampling on the membrane filters usually employed for environmental samplings. Some problems are focused concerning the sample weighing procedure, such as the electrostatic charge as well as the relative humidity on the filters. A weighing methodology is presented allowing for the minimization as well as quantitative evaluation of the errors connected with the measurements, avoiding the introduction of complicated and expensive systems for the conditioning of the weighing environment. Three atmospheric particulate concentration samplings have been carried out in a month using 5 sampling equipments at a time, detecting different environmental concentration versus different atmospheric conditions. This technique allowed evaluation of the variability of the aerosol mass concentration as well as determination of the minimum detectable quantities versus the air sampled volume. Finally a menu synthesis has been implemented for the weighing procedure to be applied to the membrane filters so that it guarantees the routine accuracy requirements to be fulfilled.

24534 (ENEA-RT-AMB–94-21) **Evolution of atmospheric pollution networks in Italy.** Bruni, S. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute). ENEA, Casaccia (Italy). Area Energia Ambiente e Salute. Sep 1994. 104p. (In Italian). Order Number DE95789770. Source: OSTI; NTIS (US Sales Only).

The scope of this report is to give an overview on the evolution of the atmospheric pollution networks (related to measured air quality data) in Italy; the analysis covers the year 1986 up to the beginning of 1991.

24535 (ETDE-DE–145) **The reduction of complex dynamical systems using principal interaction patterns.** Report - Max-Planck-Institut fuer Meteorologie, v. 161. Kwasniok, F. Max-Planck-Institut fuer Meteorologie, Hamburg (Germany). 5 May 1995. 48p. Order Number DE95790288. Source: OSTI; NTIS (US Sales Only).

A method of constructing low-dimensional nonlinear models capturing the main features of complex dynamical systems with many degrees of freedom is described. The system is projected onto a linear subspace spanned by only a few characteristic spatial structures called Principal Interaction Patterns (PIPs). The expansion coefficients are assumed to be governed by a nonlinear dynamical system. The optimal low-dimensional model is determined by identifying spatial modes and interaction coefficients describing their time evolution simultaneously according to a nonlinear variational principle. The algorithm is applied to a two-dimensional geophysical fluid system on the sphere. The models based on Principal Interaction Patterns are compared to models using Empirical Orthogonal Functions (EOFs) as basis functions. A PIP-model using 12 patterns is capable of capturing the long-term behaviour of the complete system monitored by second-order statistics, while in the case of EOFs 17 modes are necessary. (orig.)

24536 (ETDE-DE–159) **Stratospheric climate and variability from a general circulation model and observations. Pt. 2. Results for March-May, June-August and September-November.** Report - Max-Planck-Institut fuer Meteorologie, v. 164. Manzini, E.; Bengtsson, L. Max-Planck-Institut fuer Meteorologie, Hamburg (Germany). May 1995. 38p. Order Number DE95790221. Source: OSTI; NTIS (US Sales Only).

This report is the second part of a work aimed at studying the climate and variability of the large scale stratospheric circulation by comparing atmospheric statistics from a simulation performed with a general circulation model and from global analyzed observations. Part I (Manzini and Bengtsson, 1994) focused on December-February, while here the remaining part of the seasonal cycle is discussed. The March-May climatological seasonal mean zonal mean circulation is found to be reasonably well simulated. In the Northern hemisphere stratosphere, very weak westerly winds and high interannual variability characterize both the observed and model data, suggesting that the final stratospheric warming in the Northern hemisphere occurs in a realistic way in the model. The simulation of the zonal mean circulation during the June-August is relatively successful, although a winter cold bias of moderate amplitude and vertical extent is found. In comparison with the boreal winter, the interannual variability of the austral winter is smaller at high latitudes, in the simulation as well as in the observed state. Although the structure of the observed variability is captured by the model, its magnitude is underestimated, especially in August. Significant discrepancies between the model results and the analyzed observations are found during the final vortex breakdown (September-November) in the Southern hemisphere, apparently caused by insufficient large scale orographic forcing from the Antarctic continent in the current low resolution model. (orig.)

24537 (ETDE-DE–160) **The role of water vapor and convection during the Central Equatorial Pacific Experiment (CEPEX) from observations and model simulations.** Report - Max-Planck-Institut fuer Meteorologie, v. 159. Lohmann, U. (Max-Planck-Institut fuer Meteorologie, Hamburg (Germany)); Roeckner, E.; Collins, W.D.; Heymsfield, A.J.; McFarquhar, G.; Barnett, T.P. Max-Planck-Institut fuer Meteorologie, Hamburg (Germany). Mar 1995. 41p. Order Number DE95790908. Source: OSTI; NTIS (US Sales Only).

Observed data from field measurements taken during the Central Equatorial Pacific EXperiment (CEPEX) conducted from March 7 to April 5, 1993 are used to study the link between water vapor, convection and SST in comparison with results from a general circulation model (GCM). Three high resolution simulations were carried out with slightly different initial conditions using ECMWF (European Centre for Medium Range Weather Forecasts) analyses from March 1, 1993 and forced with the observed sea surface temperature (SST) as lower boundary condition. Radiosondes released between the equator and 5 S show a dry region east of the dateline collocated with a clear sky region observed from the GMS satellite in the first two weeks of CEPEX, which both vanish in the second two weeks. The model is able to reproduce this change in convective activity. Moreover, a comparison of relative humidity profiles grouped according to SST and infrared brightness temperature (IRBT) indicate that the GCM altogether captures the observed behavior. The atmosphere is relatively moist when the SST is warm and low IRBTs occur at the same time, i.e. when convection

takes place, and dryer than on average for the opposite case. In general, however, the model is too dry in the mid-troposphere and too wet in the upper troposphere. Very good agreement is found between the simulated and observed ice water content, in particular with respect to its increase with temperature. (orig.)

24538 (ETDE-DE–161) **The 19th century discussion of climate variabilility and climate change: analogies for the present debate.** Report - Max-Planck-Institut fuer Meteorologie, v. 157. Stehr, N. (Alberta Univ., Edmonton, AB (Canada). Dept. of Sociology); Storch, H. von; Fluegel, M. Max-Planck-Institut fuer Meteorologie, Hamburg (Germany). 14 Feb 1995. 30p. Order Number DE95790970. Source: OSTI; NTIS (US Sales Only).

Toward the end of the nineteenth and at the beginning of twentieth century significant discussions occurred among geographers, meteorologists and "climatologists" concerned with the notion of climate variability (Klimaschwankungen) and anthropogenic climate change (Klimawandel/Klimaaenderungen), for instance, due to deforestation and reforestation. We identifiy two protagonists of this debate, Eduard Brueckner and Julius Hann, who both accept the notion of climate variability on the decadal scale, but respond in very different ways to the discovery of climate change. Brueckener assessed the impact of climate variability on society (e.g., on health, the balance of trade, emigration to the USA), and tried to bring these to the attention of the public, whereas Hann limited himself to the immediate natural scientific problem of monitoring and documenting climate variability. We suggest that these discussions and the formation of national governmental and parliamentary committees almost 100 years ago, are not merely of historical interest. In view of the present discussion of climate variablity and anthropogenic climate change, and the need for adquate socio-economic response strategies, past and now neglected arguments may prove important for methodoligical and theoretical as well as for practical reasons. The past discussions represent a significant social and intellectual analogy for the present situation. (orig.)

24539 (ETDE-DE–172) **Tropical intraseasonal oscillation appearing in operational analyses and in a family of general circulation models.** Report - Max-Planck-Institut fuer Meteorologie, v. 165. Gualdi, S. (Max-Planck-Institut fuer Meteorologie, Hamburg (Germany)); Storch, H. von; Navarra, A. Max-Planck-Institut fuer Meteorologie, Hamburg (Germany). May 1995. 49p. Order Number DE95795715. Source: OSTI; NTIS (US Sales Only).

The statistics of the tropical intraseasonal variability (MJO) is analyzed in the ECMWF analyses and in several ECHAM GCM experiments, which have been performed with different model versions (ECHAM2 and ECHAM3), horizontal resolutions (T21, T42 and T106), and with and without annual cycle. The analysis technique is the Principal Oscillation Pattern (POP) analysis, applied to the 200 mb equatorial velocity potential. The intercomparison of ECHAM2 experiments with and without annual cycle shows that much more realistic results are obtained when the annual cycle is included in the simulation. At low resolution (T21), the improved model physics has a beneficial impact on the simulated MJO. The oscillation is more successfully reproduced in the more recent model version (ECHAM3). An increase of the horizontal resolution, in this latter case, leads to less favorable results. (orig.)

24540 (ETDE-DE–173) **The water vapour continuum and its representation in ECHAM4.** Report - Max-Planck-Institut fuer Meteorologie, v. 162. Giorgetta, M. (Max-Planck-Institut fuer Meteorologie, Hamburg (Germany)); Wild, M. Max-Planck-Institut fuer Meteorologie, Hamburg (Germany). May 1995. 47p. Order Number DE95795758. Source: OSTI; NTIS (US Sales Only).

The analysis of the longwave radiation scheme revealed the special role of water vapour among the IR-absorbing and emitting gases in the atmosphere. This is obvious by the fact that water vapour absorption is computed in two terms, i.e. the line term and the continuum term, while absorption rates for all other gases need only the line term. Curiosity for the reason of this distinction lead to the study of the corresponding literature and showed finally a way to improve the performance of the water vapour absorption within this model. The subsequently presented modifications increase the longwave downward fluxes at the surface in cold and/or dry places and help to bring model results in correspondence with observations. The following chapters lead from general properties of gaseous absorption to spectral properties of water vapour, water vapour absorption in the atmospheric window region, the definition of the continuum, and to the hypothetical explanations of the continuum. The succeeding chapters cover the continuum parameterization in ECHAM4, the applied modifications, the validation and finally an estimation of the impact on the ECHAM4 climate. (orig./HM)

24541 (FZKA–5524) **Off gas cleaning by electron beam. The mobile test facilty AGATE-M.** Albrecht, G.; Baumann, W.; Paur, H.R. Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Inst. fuer Technische Chemie. Feb 1995. 34p. (In German). Order Number DE95790228. Source: OSTI; NTIS (US Sales Only).

Industrial off gases, containing pollutants (Volatile Organic Compounds, NO_x) may be cleaned by irradiation with accelerated electrons. Laboratory tests show, that this process is especially suitable for low concentrated off gases because of high removal efficiencies at low energy consumption. In addition it must be noted, that the process is insensitive towards particulates and may be easily adjusted to different load conditions. The goals of this project are the test and the demonstration of the process in an industrial environment. The mobile test facility AGATE-M was constructed in cooperation between the Forschungszentrum Karlsruhe and the Institute for Surface Modification (IOM). As first projects we plan to use the mobile plant for cleaning the waste gases from paint production plant, from a remediation plant emitting chlorinated hydrocarbons (CHC) and from an automobil tunnel. The plant and the electron accelerator are controlled by programmable computer units. The relevant operation data are being measured by suitable instruments and saved by an electronic data logger. The gas compositions at the plants inlet and outlet are measured by flame ionization detector (FID) and by gas chromatography (GC). Additional analyzers are employed according to demand. (orig./SR)

24542 (FZKA–5529) **Depth resolving analysis of outdoor aerosol particles with secondary mass spectrometry.** Schuricht, J. Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Inst. fuer Radiochemie; Karlsruhe Univ. (T.H.) (Germany). Fakultaet fuer Chemie. Mar 1995. 121p. (In German). Order Number DE95795765. Source: OSTI; NTIS (US Sales Only).

Atmospheric aerosol particles are of significant influence to the chemistry of the atmosphere. Emission processes and the interaction with the environment often cause a depth distribution of the chemical compounds within the particles. Thus the analysis of the chemical composition of the particles as well as the analysis of their depth structure is of great importance. Moreover the reactivity of elements depend on the current compounds, so the analysis of aerosol particles should give also information on the depth distribution of compounds. These information can be obtained by mass analysis of sputter eroded material, i.e. secondary ion mass spectrometry (SIMS) and secondary neutral mass spectrometry (SNMS). Plasma-SNMS was used in this work for the quantitative determination of elemental concentrations and elemental depth profiles of atmospheric particles collected from outdoor air. (orig.)

24543 (ISTISAN–94-15) **Acid areosol: Formation, health effects, measurement methods.** Puledda, S. (Istituto Superiore di Sanita, Rome (Italy)). Istituto Superiore di Sanita, Rome (Italy). Sep 1994. 52p. (In Italian). Order Number DE95771028. Source: OSTI; NTIS (US Sales Only).

The formation of acidic aerosols in the atmosphere, linked to different types of industrial activities and to the use of fossile fuels, represents a serious environmental problem. At present, the United States Environmental Protection Agency is considering the possibility of including acidic aerosols in the group of the so-called 'criteria pollutants' for which specific limits are established. The European Union is following the same trend. This would have direct consequences on the Italian regulations. The present study discusses the formation, health effects and measurement methods for acidic aerosols, using data mostly related to the North American area, where the great majority of researches are carried out.

24544 (JAERI-Research–94-040) **Improvement of a three-dimensional atmospheric dynamic model and examination of its performance over complex terrain.** Nagai, Haruyasu (Japan

Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Yamazawa, Hiromi. Japan Atomic Energy Research Inst., Tokyo (Japan). Nov 1994. 46p. (In Japanese). Order Number DE95789462. Source: OSTI; NTIS; INIS.

A three-dimensional atmospheric dynamic model (PHYSIC) was improved and its performance was examined using the meteorological data observed at a coastal area with a complex terrain. To introduce synoptic meteorological conditions into the model, the initial and boundary conditions were improved. By this improvement, the model can predict the temporal change of wind field for more than 24 hours. Moreover, the model successfully simulates the land and sea breeze observed at Shimokita area in the summer of 1992. (author).

24545 (LA-SUB–95-98) **Desert Research Institute cloud droplet videometer measurements in support of MASTEX.** Los Alamos National Lab., NM (United States). 13 Feb 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015247. Source: OSTI; NTIS; GPO Dep.

In support of the Monterey Area Ship-Track Experiment (MASTEX) the Desert Research Institute completed modifications to an existing cloud droplet videometer and construction of a second unit for deployment on board the RV Glorita during the month of June 1994. Dr. Randolph Borys accompanied the instrumentation during the period the ship was at sea and assisted in the day-to-day experiments which were conducted on board. Unusually clear conditions and high winds contributed to the lack of opportunities to deploy the new instrument from the ship.

24546 (ORNL/TM–12861) **Environmental resources of selected areas of Hawaii: Climate, ambient air quality, and noise.** Lombardi, D.A. (Oak Ridge National Lab., TN (United States)); Blasing, T.J.; Easterly, C.E.; Reed, R.M.; Hamilton, C.B. Oak Ridge National Lab., TN (United States). Mar 1995. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014068. Source: OSTI; NTIS; GPO Dep.

This report has been prepared to make available and archive background scientific data and related information on climate, ambient air quality, and ambient noise levels collected during the preparation of the environmental impact statement (EIS) for Phases 3 and 4 of the Hawaii Geothermal Project (HGP) as defined by the state of Hawaii in its April 1989 proposal to Congress. The US Department of Energy (DOE) published a notice withdrawing its Notice of Intent to prepare the HGP-EIS. Since the state of Hawaii is no longer pursuing or planning to pursue the HGP, DOE considers the project to be terminated. The report presents a general description of the climate add air quality for the islands of Hawaii (henceforth referred to as Hawaii), Maui and Oahu. It also presents a literature review as baseline information on the health effects of sulfide. The scientific background data and related information is being made available for use by others in conducting future scientific research in these areas. This report describes the environmental resources present in the areas studied (i.e., the affected environment) and does not represent an assessment of environmental impacts.

24547 (PNL–10500-Pt.2) **Pacific Northwest Laboratory annual report for 1994 to the DOE Office of Energy Research. Part 2: Atmospheric and climate research.** Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015264. Source: OSTI; NTIS; GPO Dep.

Atmospheric research at Pacific Northwest Laboratory (PNL) occurs in conjunction with the Atmospheric Chemistry Program (ACP) and with the Atmospheric Studies in Complex Terrain (ASCOT) Program. Solicitations for proposals and peer review were used to select research projects for funding in FY 1995. Nearly all ongoing projects were brought to a close in FY 1994. Therefore, the articles in this volume include a summary of the long-term accomplishments as well as the FY 1994 progress made on these projects. The following articles present summaries of the progress in FY 1994 under these research tasks: continental and oceanic fate of pollutants; research aircraft operations; ASCOT program management; coupling/decoupling of synoptic and valley circulations; interactions between surface exchange processes and atmospheric circulations; and direct simulations of atmospheric turbulence. Climate change research at PNL is aimed at reducing uncertainties in the fundamental processes that control climate systems that currently prevent accurate predictions of climate change and its effects. PNL is responsible for coordinating and integrating the field and laboratory measurement programs, modeling studies, and data analysis activities of the Atmospheric Radiation Measurements (ARM) program. In FY 1994, PNL scientists conducted 3 research projects under the ARM program. In the first project, the sensitivity of GCM grid-ad meteorological properties to subgrid-scale variations in surface fluxes and subgrid-scale circulation patterns is being tested in a single column model. In the second project, a new and computationally efficient scheme has been developed for parameterizing stratus cloud microphysics in general circulation models. In the last project, a balloon-borne instrument package is being developed for making research-quality measurements of radiative flux divergence profiles in the lowest 1,500 meters of the Earth's atmosphere.

24548 (PNL-SA–25632) **Prognostic atmospheric and dispersion modeling in the vicinity of Rocky Flats Plant.** Fast, J.D. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830 ; AC09-89SR18035. (CONF-950430–7: 5. ANS topical meeting on emergency preparedness and response, Savannah, GA (United States), 18-21 Apr 1995). Order Number DE95014193. Source: OSTI; NTIS; INIS; GPO Dep.

A multiscale four-dimensional data assimilation technique is incorporated into a mesoscale model and evaluated using meteorological and tracer data collected during the Atmospheric Studies in Complex Terrain (ASCOT) field experiment in the winter of 1991. The mesoscale model is used to predict the interaction of synoptically-driven flows and small-scale circulations influenced by terrain along the Front Range in Colorado in the vicinity of the Rocky Flats Plant for four nocturnal periods during the ASCOT field experiment. Data assimilation is used to create dynamically consistent analysis fields based on the mesoscale forecasts and the special asynoptic data taken during this experiment. The wind and turbulence quantities produced by the mesoscale model are then used to determine the dispersion of a tracer released from the Rocky Flats Plant for each evening. The mesoscale model is able to qualitatively predict the mesobeta-scale drainage flows from the Front Range into the South Platte River basin; however, the largest forecast errors occurred in a region immediately adjacent to the foothills. As expected, the current data assimilation technique reduced the overall errors in the atmospheric and dispersion calculations while the model generated realistic small-scale circulations not resolved by the data. Still, the model did not capture the shallow surface drainage flows just east of the Rocky Flats Plant for two of the evenings during the field experiment.

24549 (PNL-SA–25949) **Solar semidiurnal tidal wind oscillations above the CART site.** Whiteman, C.D.; Bian, X. Pacific Northwest Lab., Richland, WA (United States). Mar 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9503140–9: 5. atmospheric radiation measurement (ARM) meeting, San Diego, CA (United States), 20-23 Mar 1995). Order Number DE95014612. Source: OSTI; NTIS; GPO Dep.

Harmonic analysis of wintertime data from 915- and 404-MHz radar wind profilers at four sites in North America has identified coherent semidiurnal wind oscillations through the entire depth of the troposphere. These winds are readily apparent above the CART site, as evidenced from analyses of data from the Haviland, KS, radar profiler. The characteristics of this wind system match the characteristics of solar semidiurnal atmospheric tides, as predicted by a simple dynamic model.

24550 (RFP–4972) **Toxic chemical release inventory at the Rocky Flats Environmental Technology Site.** Leonard, R.J. (Kaiser-Hill Co., Golden, CO (United States)). EG and G Rocky Flats, Inc., Golden, CO (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. (CONF-9506210–1: 10. annual Federal facilities conference, Denver, CO (United States), 29 Jun 1995). Order Number DE95014672. Source: OSTI; NTIS; GPO Dep.

The Rocky Flats Environmental Technology Site (Site) submits an annual Toxic Chemical Release Inventory (Form R) as required under the Emergency Planning and Community Right-to-Know Act (EPCRA). The Site uses a multi-step process for completing the Form R which includes developing a written procedure, determine thresholds, collection of chemical use and fate information, and peer review.

24551 (UCRL-JC-118633) **Development of the Emission Measurement and Information Tracking System (EMITS) for regulatory analysis.** McCormack, C.E.; Dorenkamp, L.D. Lawrence Livermore National Lab., CA (United States). Oct 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941138-1: International specialty conference: the emission inventory - applications and improvements, Raleigh, NC (United States), 1-3 Nov 1994). Order Number DE95014512. Source: OSTI; NTIS; GPO Dep.

With the constant implementation of complex and restrictive state and federal clean air laws, a facility must have a comprehensive understanding of the types and amount of emissions associated with the facility's operations. Knowledge of the facility's emissions is essential to assess the operational impacts of current and upcoming legislation. Lawrence Livermore National Laboratory (LLNL), located in California, is regulated by federal, state, and local air quality agencies. Of most concern to the facility is California's Assembly Bill 2588 (also known as the "Air Toxics Hot Spots" program) and the federal Title III, Title V, and Title VI provisions of the Clean Air Act as amended in 1990. Because of the complex regulatory requirements, LLNL needed a system to calculate and classify air emissions by each applicable regulatory program. This paper outlines the development of LLNL's comprehensive emissions inventory known as the Emissions Measurement and Information Tracking System (EMITS).

24552 (UCRL-JC-120469) **Computational fluid dynamics modeling for emergency preparedness and response.** Lee, R.L.; Albritton, J.R.; Ermak, D.L.; Kim, J. Lawrence Livermore National Lab., CA (United States). Feb 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950927-4: International conference and workshop on modeling and mitigating the consequences of accidental releases of hazardous materials, New Orleans, LA (United States), 26-29 Sep 1995). Order Number DE95013432. Source: OSTI; NTIS; GPO Dep.

Computational fluid dynamics (CFD) has (CFD) has played an increasing in the improvement of atmospheric dispersion modeling. This is because many dispersion models are now driven by meteorological fields generated from CFD models or, in numerical weather prediction's terminology, prognostic models. Whereas most dispersion models typically involve one or a few scalar, uncoupled equations, the prognostic equations are a set of highly-couple equations whose solution requires a significant level of computational power. Recent advances in computer hardware and software have enabled modestly-priced, high performance, workstations to exhibit the equivalent computation power of some mainframes. Thus desktop-class machines that were limited to performing dispersion calculations driven by diagnostic wind fields may now be used to calculate complex flows using prognostic CFD models. The Release and Advisory Capability (ARAC) program at Lawrence Livermore National Laboratory (LLNL) has, for the past several years, taken advantage of the improvements in hardware technology to develop a national emergency response capability based on executing diagnostic models on workstations. Diagnostic models that provide wind fields are, in general, simple to implement, robust and require minimal time for execution. Because these models typically contain little physics beyond mass-conservation, their performance is extremely sensitive to the quantity and quality of input meteorological data and, in spite of their utility, can be applied with confidence to only modestly complex flows. We are now embarking on a development program to incorporate prognostic models to generate, in real-time, the meteorological fields for the dispersion models. In contrast to diagnostic models, prognostic models are physically-based and are capable of incorporating many physical processes to treat highly complex flow scenarios.

24553 (UCRL-JC-120645) **OH generation in steam-air pulsed corona.** Garcia, M.; Chang, B. Lawrence Livermore National Lab., CA (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950875-1: International symposium on plasma chemistry, Minneapolis, MN (United States), 21-25 Aug 1995). Order Number DE95013293. Source: OSTI; NTIS; GPO Dep.

The measurement of OH concentration in a pulsed corona discharge through a steam-air mixture is compared with a chemical kinetics model. The original motivation was to develop a technological hydroxilizer for oxidizing gas pollutants to acids. Time dependent measurements of the 3,064 Å emission of OH indicate a production of nearly 4 ppm within a spark. This measurement was accomplished by a 1 ns resolution photomultiplier with a 100 Å filter centered at 3080 Å. The discharge occurs across a 1 cm coaxial gap between a central anode tube and an outer cylindrical cathode cased in glass and at ground potential. The water-air mixture is of equal proportions and at 1 atmosphere. Pulsed voltage of 38 kV and 60 ns risetime produces a 60 A, 20 ns spark. The model predicts comparable OH production by dissociation in the air-water mixture after 100 ns of 10^{12} electrons/cm^3. The electron density is set to zero during the subsequent 100 μs in the model, and thereafter OH is seen as a short-lived reaction product of HO_2 with O and N atoms. The sequence of reaction is: 100 ns of dissociation to peak OH concentration, 0.2 μs for hydrogen atom loss and HO_2 formation, 20 μs for O atom loss and O_3 formation, beyond 20 μs NO formation from N atoms with OH and HO_2. In the model HO_2 ultimately decays by slowly forming H_2O_2, so it may be viewed as a stable fuel which produces OH when combined with atomic oxygen or nitrogen.

24554 (UCRL-JC-120927) **Climate signal and weather noise.** Leith, C.E. Lawrence Livermore National Lab., CA (United States). Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506191-1: 6. international meeting on statistical climatology, Galway (Ireland), Jun 1995). Order Number DE95011752. Source: OSTI; NTIS; GPO Dep.

A signal of small climate change in either the real atmosphere or numerical simulation of it tends to be obscured by chaotic weather fluctuations. Time-lagged covariances of such weather processes are used to estimate the sampling errors of time average estimates of climate parameters. Climate sensitivity to changing external influences may also be estimated using the fluctuation dissipation relation of statistical mechanics. Answers to many climate questions could be provided by a realistic stochastic model of weather and climate.

24555 (UCRL-JC-121009) **Ensemble techniques for seasonal prediction.** Palmer, T.N. (and others); Buizza, R.; Brankovic, C. Lawrence Livermore National Lab., CA (United States). Apr 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9504178-1: 1995 tropical and ocean global atmosphere (TOGA) conference, Melbourne (Australia), 2-7 Apr 1995). Order Number DE95014393. Source: OSTI; NTIS; GPO Dep.

The prediction of interannual climate fluctuations is discussed. The role that ensemble techniques can play is addressed.

24556 (WHC-SD-GN-SWD-30003-Rev.1) **GXQ program verification and validation. Revision 1.** Hey, B.E. Westinghouse Hanford Co., Richland, WA (United States). 10 May 1995. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012581. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the program user's guide of a general purpose atmospheric dispersion code named GXQ. GXQ is an IBM Compatible microcomputer based program for calculating atmospheric dispersion coefficients using Hanford site specific joint frequency data. It uses the Gaussian straight line model to calculate either an atmospheric dispersion coefficient (X/Q') or a maximum normalized air concentration (X/Q). Several options are available to the user which alter the standard Gaussian model to allow for plume depletion, building wake, plume meander, sector averaging, gravitational settling and plume rise. Additional options

control handling of the joint frequency data and output. Combinations of the above allow calculation of X/Q' in accordance with Nuclear Regulatory Commission Regulatory Guide 1.145. The GXQ source code listing is provided in an appendix.

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Refer also to citation(s) 23090, 23091, 23125, 23169, 23172, 23173, 23177, 23189, 23208, 23210, 23212, 23213, 23214, 23227, 23238, 23239, 23240, 23253, 23261, 23262, 23315, 23316, 23317, 23318, 23328, 23337, 23338, 23340, 23341, 23342, 23347, 23351, 23363, 23364, 23366, 23412, 23453, 23454, 23455, 23456, 23480, 23694, 23697, 23705, 23708, 23718, 23800, 23966, 24065, 24303, 24393, 24395, 24705, 24728

24557 (ANL/CMT/PP–80445) **A quantitative method to detect explosives and selected semivolatiles in soil samples by Fourier transform infrared spectroscopy.** Clapper-Gowdy, M. (Argonne National Lab., IL (United States)); Dermirgian, J.; Robitaille, G. Argonne National Lab., IL (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013551. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a novel Fourier transform infrared (FTIR) spectroscopic method that can be used to rapidly screen soil samples from potentially hazardous waste sites. Samples are heated in a thermal desorption unit and the resultant vapors are collected and analyzed in a long-path gas cell mounted in a FTIR. Laboratory analysis of a soil sample by FTIR takes approximately 10 minutes. This method has been developed to identify and quantify microgram concentrations of explosives in soil samples and is directly applicable to the detection of selected volatile organics, semivolatile organics, and pesticides.

24558 (ANL/EA/CP–84325) **An accelerated remedial strategy developed for J-Field, Aberdeen Proving Ground, Maryland.** Yuen, C.R. (Argonne National Lab., IL (United States)); Martino, L.; Patton, T.; Wrobel, J. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950451–2: 21. national environmental symposium and exhibition, San Diego, CA (United States), 17-21 Apr 1995). Order Number DE95012926. Source: OSTI; NTIS; GPO Dep.

For an installation with many disposal sites and multiple contaminant sources, successful remediation at minimum cost can be complicated by insufficient geologic and hydrogeologic information, incomplete records of historical disposal activities, and uncertainty about the effectiveness of different investigative methods. To reduce these uncertainties and to increase the probability of successful remediation at minimum cost, a "Phased and pilot" accelerated remedial strategy has been developed for the J-Field area of Aberdeen Proving Ground, Maryland. The strategy includes four phases. First, the most contaminated site is selected as a pilot for detailed investigation. Second, the most contaminated areas within the pilot site are chosen as a pilot source area for interim action study, and a remedial action is developed to remove the primary contaminant sources. The subsequent sitewide investigation uses the effective tools developed in the first phase. Third, a cleanup operation is initiated in the pilot source area, while a sitewide feasibility study is developed by taking advantage of lessons learned in the interim action. Fourth, a sitewide cleanup operation proceeds.

24559 (ANL/EA/CP–85472) **A Bayesian/geostatistical approach to the design of adaptive sampling programs.** Johnson, R.L. (Argonne National Lab., IL (United States). Environmental Assessment Div.). Argonne National Lab., IL (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950159–2: Workshop and symposium on geostatistics for geotechnical and environmental applications, Phoenix, AZ (United States), 26-27 Jan 1995). Order Number DE95013500. Source: OSTI; NTIS; GPO Dep.

Traditional approaches to the delineation of subsurface contamination extent are costly and time consuming. Recent advances in field screening technologies present the possibility for adaptive sampling programs–programs that adapt or change to reflect sample results generated in the field. A coupled Bayesian/geostatistical methodology can be used to guide adaptive sampling programs. A Bayesian approach quantitatively combines "soft" information regarding contaminant location with "hard" sampling results. Soft information can include historical information, non-intrusive geophysical survey data, preliminary transport modeling results, past experience with similar sites, etc. Soft information is used to build an initial conceptual image of where contamination is likely to be. As samples are collected and analyzed, indicator kriging is used to update the initial conceptual image. New sampling locations are selected to minimize the uncertainty associated with contaminant extent. An example is provided that illustrates the methodology.

24560 (ANL/EA/CP–86344) **Land cover change and remote sensing: Examples of quantifying spatiotemporal dynamics in tropical forests.** Krummel, J.R. (Argonne National Lab., IL (United States)); Su, Haiping; Fox, J.; Yarnasan, S.; Ekasingh, M. Argonne National Lab., IL (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9503154–1: Remote sensing and environmental monitoring for the sustainable development of the Americas, San Juan (Puerto Rico), 21-22 Mar 1995). Order Number DE95012272. Source: OSTI; NTIS; GPO Dep.

Research on human impacts or natural processes that operate over broad geographic areas must explicitly address issues of scale and spatial heterogeneity. While the tropical forests of Southeast Asia and Mexico have been occupied and used to meet human needs for thousands of years, traditional forest management systems are currently being transformed by rapid and far-reaching demographic, political, economic, and environmental changes. The dynamics of population growth, migration into the remaining frontiers, and responses to national and international market forces result in a demand for land to produce food and fiber. These results illustrate some of the mechanisms that drive current land use changes, especially in the tropical forest frontiers. By linking the outcome of individual land use decisions and measures of landscape fragmentation and change, the aggregated results shows the hierarchy of temporal and spatial events that in summation result in global changes to the most complex and sensitive biome – tropical forests. By quantifying the spatial and temporal patterns of tropical forest change, researchers can assist policy makers by showing how landscape systems in these tropical forests are controlled by physical, biological, social, and economic parameters.

24561 (ANL/EAD/TM–38-Vol.1) **Remedial investigation sampling and analysis plan for J-Field, Aberdeen Proving Ground, Maryland. Volume 1: Field Sampling Plan.** Benioff, P.; Biang, R.; Dolak, D.; Dunn, C.; Martino, L.; Patton, T.; Wang, Y.; Yuen, C. Argonne National Lab., IL (United States). Mar 1995. 198p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95011643. Source: OSTI; NTIS; GPO Dep.

The Environmental Management Division (EMD) of Aberdeen Proving Ground (APG), Maryland, is conducting a remedial investigation and feasibility study (RI/FS) of the J-Field area at APG pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. J-Field is within the Edgewood Area of APG in Harford County, Maryland (Figure 1. 1). Since World War II activities in the Edgewood Area have included the development, manufacture, testing, and destruction of chemical agents and munitions. These materials were destroyed at J-Field by open burning and open detonation (OB/OD). Considerable archival information about J-Field exists as a result of efforts by APG staff to characterize the hazards associated with the site. Contamination of J-Field was first detected during an environmental survey of the Edgewood Area conducted in 1977 and 1978 by the US Army Toxic and Hazardous Materials Agency (USATHAMA) (predecessor to the US Army Environmental Center [AEC]). As part of a subsequent USATHAMA -environmental survey, 11 wells were installed and sampled at J-Field. Contamination at J-Field was also detected during a munitions disposal survey conducted by Princeton Aqua Science in 1983. The Princeton Aqua Science investigation involved the installation and sampling of nine

wells and the collection and analysis of surficial and deep composite soil samples. In 1986, a Resource Conservation and Recovery Act (RCRA) permit (MD3-21-002-1355) requiring a basewide RCRA Facility Assessment (RFA) and a hydrogeologic assessment of J-Field was issued by the US Environmental Protection Agency (EPA). In 1987, the US Geological Survey (USGS) began a two-phased hydrogeologic assessment in data were collected to model, groundwater flow at J-Field. Soil gas investigations were conducted, several well clusters were installed, a groundwater flow model was developed, and groundwater and surface water monitoring programs were established that continue today.

24562 (ANL/EAD/TM–39) **Work plan for focused feasibility study of the toxic burning pits area at J-Field, Aberdeen Proving Ground, Maryland.** Biang, C.; Benioff, P.; Martino, L.; Patton, T. Argonne National Lab., IL (United States). Environmental Assessment Div. Mar 1995. 87p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95011641. Source: OSTI; NTIS; GPO Dep.

The Environmental Management Division (EMD) of Aberdeen Proving Ground (APG), Maryland, is conducting a remedial investigation and feasibility study (RI/FS) of the J-Field area at APG pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCIA). J-Field is within the Edgewood Area of APG in Harford County, Maryland. Since World War II, activities in the Edgewood Area have included the development, manufacture, testing, and destruction of chemical agents and munitions. These materials were destroyed at J-Field by open burning and open detonation (OB/OD). Considerable archival information about J-Field exists as a result of efforts by APG staff to characterize the hazards associated with the site. Contamination of J-Field was first detected during an environmental survey of the Edgewood Area conducted in 1977 and 1978 by the US Army Toxic and Hazardous Materials Agency (USATHAMA)(predecessor to the US Army Environmental Center). As part of a subsequent USATHAMA environmental survey, 11 wells were installed and sampled at J-Field. Contamination at J-Field was also detected during a munitions disposal survey conducted by Princeton Aqua Science in 1983. The Princeton Aqua Science investigation involved the installation and sampling of nine wells and the collection and analysis of surficial and deep composite soil samples. In 1986, a Resource Conservation and Recovery Act (RCRA) permit (MD3-21-0021355) requiring a basewide RCRA Facility Assessment (RFA) and a hydrogeologic assessment of J-Field was issued by the US Environmental Protection Agency (EPA). In 1987, the US Geological Survey (USGS) began a two-phased hydrogeologic assessment in which data were collected to model groundwater flow at J-Field. Soil gas investigations were conducted, several well clusters were installed, a groundwater flow model was developed, and groundwater and surface water monitoring programs were established that continue today.

24563 (ANL/EAD/TM–45) **Work plan for conducting an ecological risk assessment at J-Field, Aberdeen Proving Ground, Maryland.** Hlohowskyj, I. (Argonne National Lab., IL (United States). Environmental Assessment Div.); Hayse, J.; Kuperman, R. Argonne National Lab., IL (United States). Mar 1995. 174p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95015178. Source: OSTI; NTIS; GPO Dep.

The Environmental Management Division of Aberdeen Proving Ground (APG), Maryland, is conducting a remedial investigation and feasibility study (RI/FS) of the J-Field area at APG pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. J-Field is within the Edgewood Area of APG in Harford County, Maryland, and activities at the Edgewood Area since World War II have included the development, manufacture, testing, and destruction of chemical agents and munitions. The J-Field site was used to destroy chemical agents and munitions by open burning and open detonation. This work plan presents the approach proposed to conduct an ecological risk assessment (ERA) as part of the RI/FS program at J-Field. This work plan identifies the locations and types of field studies proposed for each area of concern (AOC), the laboratory studies proposed to evaluate toxicity of media, and the methodology to be used in estimating doses to ecological receptors and discusses the approach that will be used to estimate and evaluate ecological risks at J-Field. Eight AOCs have been identified at J-Field, and the proposed ERA is designed to evaluate the potential for adverse impacts to ecological receptors from contaminated media at each AOC, as well as over the entire J-Field site. The proposed ERA approach consists of three major phases, incorporating field and laboratory studies as well as modeling. Phase 1 includes biotic surveys of the aquatic and terrestrial habitats, biological tissue sampling and analysis, and media toxicity testing at each AOC and appropriate reference locations. Phase 2 includes definitive toxicity testing of media from areas of known or suspected contamination or of media for which the Phase 1 results indicate toxicity or adverse ecological effects. In Phase 3, the uptake models initially developed in Phase 2 will be finalized, and contaminant dose to each receptor from all complete pathways will be estimated.

24564 (CONF-950209–8) **Assays and screening of alpha contaminated soils using low-resolution alpha spectroscopy of thick soil samples.** Meyer, K.E. (Oak Ridge National Lab., TN (United States)); Lucas, A.C.; Padovan, S. Oak Ridge National Lab., TN (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. ttp # OR158102. From 4. international symposium on field screening methods for hazardous wastes and toxic chemicals; Las Vegas, NV (United States); 22-24 Feb 1995. Order Number DE95008969. Source: OSTI; NTIS; INIS; GPO Dep.

A new approach to estimating concentrations of alpha-emitting contaminants (e.g. U, Th, Ra, Pu, Am) in soil samples has been evaluated. The Victoreen Alpha Activity Monitor has been designed to empirically assay soil samples using low-resolution alpha spectroscopy, of thick soil samples. Pre-processing of the soil samples is minimal, involving only drying the soils and milling them to reduce inhomoceneities. Several laboratory tests of the instrument have been conducted. It has been shown that the instrument obeys simple counting statistics with measurement reproducibility improving with the inverse square root of the counting time. Using acquisition times of 1 to 24 hours the instrument Generated alpha assays of eighteen reference and field soil samples which were in good agreement with radiochemical analyses. It was observed that the alpha activity due to a 10pCi/g ^{239}Pu spike added to a clean soil could be very readily distinguished from the 14pCi/g background activity of the soil. In a mock field screening test of 100 Pu-contaminated soils, the instrument demonstrated screening success rates ranging from 70% (at a screening level of 5pCi/g) to greater than 90% (at a screening level of 30pCi/g).

24565 (CONF-950450–10) **High resolution airborne geophysics at hazardous waste disposal sites.** Beard, L.P. (Oak Ridge National Lab., TN (United States)); Nyquist, J.E.; Doll, W.E.; Chong Foo, M.; Gamey, T.J. Oak Ridge National Lab., TN (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. annual symposium on the application of geophysics to environmental and engineering problems; Orlando, FL (United States); 23-27 Apr 1995. Order Number DE95013050. Source: OSTI; NTIS; GPO Dep.

In 1994, a high resolution helicopter geophysical survey was conducted over portions of the Oak Ridge Reservation, Tennessee. The 1800 line kilometer survey included multi-frequency electromagnetic and magnetic sensors. The areas covered by the high resolution portion of the survey were selected on the basis of their importance to the environmental restoration effort and on data obtained from the reconnaissance phase of the airborne survey in which electromagnetic, magnetic, and radiometric data were collected over the entire Oak Ridge Reservation in 1992–1993. The high resolution phase had lower sensor heights, more and higher EM frequencies, and tighter line spacings than did the reconnaissance survey. When flying over exceptionally clear areas, the high resolution bird came within a few meters of the ground surface. Unfortunately, even sparse trees and power or phone lines could prevent the bird from being towed safely at low altitude, and over such areas it was more usual for it to be flown at about the same altitude as the bird in the reconnaissance survey, about 30m. Even so, the magnetometers used in the high resolution phase were 20m

closer to the ground than in the reconnaissance phase because they were mounted on the tail of the bird rather than on the tow cable above the bird. The EM frequencies used in the high resolution survey ranged from 7400Hz to 67000Hz. Only the horizontal coplanar loop configuration was used in the high resolution flyovers.

24566 (CONF-951006–10) **Estimation of contaminant transport in groundwater beneath radioactive waste disposal facilities.** Wang, J.C.; Tauxe, J.D.; Lee, D.W. Oak Ridge National Lab., TN (United States). 25 May 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (United States); 29 Oct - 1 nov 1995. Order Number DE95014577. Source: OSTI; NTIS; INIS; GPO Dep.

Performance assessments are required for low-level radioactive waste disposal facilities to demonstrate compliance with the performance objectives, consider human exposures from water, air, and inadvertent intruder pathways. Among these, the groundwater pathway analysis usually involves complex numerical simulations with results which are often difficult to verify and interpret. This paper presents a technique to identify and simplify the essential parts of the groundwater analysis. The transport process of radionuclides including infiltration of precipitation, leachate generation, and advection and dispersion in the groundwater is divided into several steps. For each step, a simple analytical model is constructed and refined to capture the dominant phenomena represented in the complex analysis included in a site-specific performance assessment. This step-wise approach provides a means for gaining insights into the transport process and obtaining reasonable estimates of relevant quantities for facility design and site evaluation.

24567 (DOE/AL/62350–99-Rev.1) **UMTRA Project water sampling and analysis plan, Salt Lake City, Utah. Revision 1.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jun 1995. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95015576. Source: OSTI; NTIS; INIS; GPO Dep.

This water sampling and analysis plan describes planned, routine ground water sampling activities at the US Department of Energy Uranium Mill Tailings Remedial Action Project site in Salt Lake City, Utah. This plan identifies and justifies sampling locations, analytical parameters, detection limits, and sampling frequencies for routine monitoring of ground water, sediments, and surface waters at monitoring stations on the site.

24568 (DOE/AL/62350–187) **Long-term surveillance plan for the Falls City Disposal Site, Falls City, Texas.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jun 1995. 135p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE95013796. Source: OSTI; NTIS; INIS; GPO Dep.

This long-term surveillance plan (LTSP) for the Uranium Mill Tailings Remedial Action (UMTRA) Project Falls City disposal site, Falls City, Texas, describes the surveillance activities for the disposal site. DOE will carry out these activities to ensure that the disposal cell continues to function as designed. This LTSP was prepared as a requirement for acceptance under the US Nuclear Regulatory Commission (NRC) general license for custody and long-term care of residual radioactive materials. This LTSP documents whether the land and interests are owned by the United States and details how long-term care of the disposal site will be carried out. It is based on the DOE's Guidance for Implementing the UMTRA Project Long-term Surveillance Program (DOE, 1992a).

24569 (DOE/AL/85832–T4) **Environmental restoration at the Pantex Plant. Quarterly progress report, April 12, 1995–June 30, 1995.** Charbeneau, R.J. Texas Univ., Austin, TX (United States). Center for Research in Water Resources. 19 Jun 1995. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-95AL85832. Order Number DE95015524. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the Work Plans for activities associated with Environmental Restoration of the perched aquifer and contaminated soils at the Pantex Plant. The Higher Education Consortium/ Pantex Research Laboratory is participating in the Consortium Grant to evaluate subsurface remediation alternatives for the perched aquifer at the Pantex Plant. Research activities will develop site characterization data and evaluate remediation alternatives for the perched aquifer and the overlying vadose zone. The work plans cover research activities for the remainder of FY95, and proposed activities for FY96 and thereafter. A separate document will present more detailed plans for FY96 activities and budget requirements.

24570 (DOE/AL/85832–T5) **Explosives disposal demonstration projects. Progress report, April 12, 1995–June 30, 1995.** Charbeneau, R. Amarillo National Resource Center for Plutonium, TX (United States). [1995]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-95AL85832. Order Number DE95015525. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains quarterly reports on two projects. The first is undertaking the environmental restoration at the Pantex Plant. Research objectives are organized under four general tasks: field testing and produced water treatment, bioremediation of contaminated groundwater and soils, vadose zone remediation, and chromium remediation. The other project goal is to demonstrate generation of diamond by explosive compression of Carbon 60 and Carbon 70 and mixtures of these fullerenes. The intent is to exploit expertise developed by Pantex and other DOE Laboratories in the area of understanding and modeling of explosive compression for initiation of nuclear fission reactions to explosively compress carbon in the form of fullerenes with the goal of transforming the material into the diamond phase.

24571 (DOE/BP–2586) **Asotin Creek Model Watershed Plan.** Browne, D.; Holzmiller, J.; Koch, F.; Polumsky, S.; Schlee, D.; Thiessen, G.; Johnson, C. Asotin County Conservation District, Clarkston, WA (United States). Landowner Steering Committee. Apr 1995. 211p. Sponsored by USDOE, Washington, DC (United States). U.S.Department of Agriculture; U.S.Forestry Service; Washington Order Number DE95014643. Source: OSTI; NTIS; GPO Dep.

The Asotin Creek Model Watershed Plan is the first to be developed in Washington State which is specifically concerned with habitat protection and restoration for salmon and trout. The plan is consistent with the habitat element of the "Strategy for Salmon". Asotin Creek is similar in many ways to other salmon-bearing streams in the Snake River system. Its watershed has been significantly impacted by human activities and catastrophic natural events, such as floods and droughts. It supports only remnant salmon and trout populations compared to earlier years. It will require protection and restoration of its fish habitat and riparian corridor in order to increase its salmonid productivity. The watershed coordinator for the Asotin County Conservation District led a locally based process that combined local concerns and knowledge with technology from several agencies to produce the Asotin Creek Model Watershed Plan.

24572 (DOE/EH/79003–T3) **Technical support services to assist the Office of Environmental Audit in conducting the DOE Environmental Survey and to provide technical assistance on Environmental Compliance issues. Technical progress report, February 16, 1990–August 13, 1990.** NUS Corp., Gaithersburg, MD (United States). [1995]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-87EH79003. Order Number DE95014970. Source: OSTI; NTIS; GPO Dep.

NUS received authorization from DOE on August 14, 1987 to provide technical support services to assist the Office of Environmental Audit (OEV) in conducting the DOE Environmental Survey and to provide technical assistance on environmental compliance issues. The overall contract is to accomplish a one-time, no-fault baseline Survey of all DOE operating facilities, and to provide technical assistance and support for the resolution of environmental compliance issues. NUS has completed the Preliminary Reports and continues to support DOE on the Prioritization and Tiger Team Assessment efforts. The project requires a broad range of environmental protection expertise, necessitating senior-level personnel as the primary project staff. Many of the tasks assigned by DOE require quick startup and performance, and several tasks may be active at any one time.

24573 (DOE/EH/79003–T4) **Technical support services to assist the Office of Environmental Audit in conducting the DOE Environmental Survey and to provide technical assistance on Environmental Compliance issues. Technical progress report, August 14, 1990–February 15, 1991.** NUS Corp., Gaithersburg, MD (United States). [1995]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-87EH79003. Order Number DE95014969. Source: OSTI; NTIS; GPO Dep.

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24574 (DOE/EH/79003–T5) **Technical support services to assist the Office of Environmental Audit in conducting the DOE Environmental Survey and to provide technical assistance on Environmental Compliance issues. Technical progress report, February 16, 1991–August 16, 1991.** Halliburton NUS Environmental Corp., Gaithersburg, MD (United States). [1995]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-87EH79003. Order Number DE95014968. Source: OSTI; NTIS; GPO Dep.

HALLIBURTON NUS received authorization from DOE on August 14, 1987 to provide technical support to assist the Office of Environmental Audit (OEV) in conducting the DOE Environmental Survey and to provide technical assistance on environmental compliance issues. The overall contract is to accomplish a one-time, no-fault baseline Survey of all DOE operating facilities, and to provide technical assistance and support for the resolution of environmental compliance issues. NUS has completed the Preliminary Reports and continues to support DOE on the Prioritization and Tiger Team Assessment efforts. The project requires a broad range of environmental protection expertise, necessitating senior-level personnel as the primary project staff. Many of the tasks assigned by DOE require quick startup and performance, and several tasks may be active at any one time. The objective of the DOE Environmental Survey Program is to identify and prioritize areas of existing environmental risk at 36 DOE facilities. NUS'role is to technically assist the Office of Environmental Audit in the implementation of the Surveys.

24575 (DOE/EM–0248) **Contaminant plumes containment and remediation focus area. Technology summary.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Jun 1995. 244p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016125. Source: OSTI; NTIS; INIS; GPO Dep.

EM has established a new approach to managing environmental technology research and development in critical areas of interest to DOE. The Contaminant Plumes Containment and Remediation (Plumes) Focus Area is one of five areas targeted to implement the new approach, actively involving representatives from basic research, technology implementation, and regulatory communities in setting objectives and evaluating results. This document presents an overview of current EM activities within the Plumes Focus Area to describe to the appropriate organizations the current thrust of the program and developing input for its future direction. The Plumes Focus Area is developing remediation technologies that address environmental problems associated with certain priority contaminants found at DOE sites, including radionuclides, heavy metals, and dense non-aqueous phase liquids (DNAPLs). Technologies for cleaning up contaminants of concern to both DOE and other federal agencies, such as volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), and other organics and inorganic compounds, will be developed by leveraging resources in cooperation with industry and interagency programs.

24576 (DOE/ER/61888–1) **Assessing the impacts of climate change on natural resource systems.** Frederick, K.D.; Rosenberg, N.J. (eds.). Resources for the Future, Inc., Washington, DC (United States). Dept. of Energy and Natural Resources. 30 Nov 1994. 384p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI02-94ER61888. Order Number DE95008993. Source: OSTI; NTIS; GPO Dep.

This volume is a collection of papers addressing the theme of potential impacts of climatic change. Papers are entitled Integrated Assessments of the Impacts of Climatic Change on Natural Resources: An Introductory Editorial; Framework for Integrated Assessments of Global Warming Impacts; Modeling Land Use and Cover as Part of Global Environmental Change; Assessing Impacts of Climatic Change on Forests: The State of Biological Modeling; Integrating Climatic Change and Forests: Economic and Ecological Assessments; Environmental Change in Grasslands: Assessment using Models; Assessing the Socio-economic Impacts of Climatic Change on Grazinglands; Modeling the Effects of Climatic Change on Water Resources- A Review; Assessing the Socioeconomic Consequences of Climate Change on Water Resources; and Conclusions, Remaining Issues, and Next Steps.

24577 (DOE/ID/12735–T35) **Projects at the Western Environmental Technology Office. Quarterly technical progress report, January 1–March 31, 1995.** MSE, Inc., Butte, MT (United States). [1995]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88ID12735. Order Number DE95013077. Source: OSTI; NTIS; GPO Dep.

This quarterly report briefly describes recent progress in eight projects. The projects are entitled Biomass Remediation Project; Heavy Metal-Contaminated Soil Project; MHD Shutdown; Mine Waste Technology Program; Plasma Projects; Resource Recovery Project; Spray Casting Project; and Watervliet Arsenal Project.

24578 (DOE/NV/10845–53) **Fate and transport processes controlling the migration of hazardous and radioactive materials from the Area 5 Radioactive Waste Management Site (RWMS).** Estrella, R. Nevada Univ., Reno, NV (United States). Desert Research Inst. Oct 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-90NV10845. Order Number DE95013100. Source: OSTI; NTIS; INIS; GPO Dep.

Desert vadose zones have been considered as suitable environments for the safe and long-term isolation of hazardous wastes. Low precipitation, high evapotranspiration and thick unsaturated alluvial deposits commonly found in deserts make them attractive as waste disposal sites. The fate and transport of any contaminant in the subsurface is ultimately determined by the operating retention and transformation processes in the system and the end result of the interactions among them. Retention (sorption) and transformation are the two major processes that affect the amount of a contaminant present and available for transport. Retention processes do not affect the total amount of a contaminant in the soil system, but rather decrease or eliminate the amount available for transport at a given point in time. Sorption reactions retard the contaminant migration. Permanent binding of solute by the sorbent is also possible. These processes and their interactions are controlled by the nature of the hazardous waste, the properties of the porous media and the geochemical and environmental conditions (temperature, moisture and vegetation). The present study summarizes the available data and investigates the fate and transport processes that govern the migration of contaminants from the Radioactive Waste Management Site (RWMS) in Area 5 of the Nevada Test Site (NTS). While the site is currently used only for low-level radioactive waste disposal, past practices have included burial of material now considered hazardous. Fundamentals of chemical and biological transformation processes are discussed subsequently, followed by a discussion of relevant results.

24579 (DOE/OR–2006) **Aqueous-stream uranium-removal technology cost/benefit and market analysis.** Kapline Enterprises, Inc., Knoxville, TN (United States). Mar 1994. 247p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95016400. Source: OSTI; NTIS; INIS; GPO Dep.

The primary purpose of this report is to present information that was gathered by Kapline Enterprises, Inc. (KEI) in order to help the Department of Energy (DOE) determine the merit of continued biosorption research funding. However, in the event that funding is continued, it is also intended to help the researchers in their efforts to develop a better uranium-removal process. This report (1) provides a comparison of DOE sites that may utilize aqueous-stream, uranium-removal biosorption technology, (2) presents a comparison of the biosorption and ion exchange processes, and (3) establishes performance criteria by which the project can be measured. It also attempts to provide focus for biosorbent ground-water-remediation research and to ask questions that need to be answered. This report is primarily a study of the US market for technologies that remove uranium from aqueous streams, but it also addresses the international market-particularly for Germany. Because KEI's access to international market information is extremely limited, the material presented in this report represents a best effort to obtain this data. Although uranium-contaminated aqueous streams are a problem in other countries as well, the scope of this report is primarily limited to the US and Germany for two reasons: (1) Germany is the country of the biosorbent-CRADA partner and (2) time constraints.

24580 (DOE/OR/22028–T19) **DOE Oak Ridge Environmental Restoration Program technical support contractor monthly project status report.** Jacobs Engineering Group, Inc., Oak Ridge, TN (United States). Jun 1995. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-93OR22028. Order Number DE95015262. Source: OSTI; NTIS; INIS; GPO Dep.

Jacobs ER Team management focused attention on preparation of FY 1996 work agreements. The Team planned work scope to reflect approximately the same level of budget as was provided for the TSC in FY 1995. The Team reviewed each draft work agreement in detail to assure consistency with DOE guidance. June 1995 activities included: undertaking an initiative to streamline the internal task order revision process; providing support to help strategize a cost-effective means of recycling valuable metals from K-25; and conducting monthly task order reviews in Oak Ridge, Portsmouth and Paaucah.

24581 (DOE/RL–93-64-Rev.2) **Sodium Dichromate expedited response action assessment. Revision 2.** USDOE, Washington, DC (United States). May 1995. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-93RL12367. Order Number DE95012047. Source: OSTI; NTIS; INIS; GPO Dep.

The Washington State Department of Ecology (lead agency) and the US Environmental Protection Agency (support agency) recommended that the US Department of Energy perform an expedited response action (ERA) for the Sodium Dichromate Barrel Disposal Landfill. The ERA goal is to reduce the potential for any contaminant migration from the landfill to the soil column, groundwater, and the Columbia River. Because the Sodium Dichromate Barrel Disposal Landfill is the only waste site within the operable unit, this removal action is the final remediation of the 100-IU-4 Operable Unit. A total of 144 anomalies and 11 subsurface zones were inspected and excavated. various homestead debris (wire fencing, wooden posts, and other miscellaneous debris) and about 5,000 crushed barrels were removed and transported to the Hanford Central Landfill. Besides containing crushed drums, four zones included some loose asbestos, one crushed drum full of asbestos, two 5-gal roofing tar cans, a 12-volt vehicle battery, one empty paint can, and used oil and grease containers (about 0.5 gal total). These materials were placed in three 55-gal drums and sent to an offsite hazardous waste disposal facility permitted to receive hazardous materials. Because the cleanup activities removed all hazardous substances, the site is clean and available for unrestricted land use.

24582 (DOE/SR/18159–4) **The effect of soil mineral phases on the abiotic degradation of selected organic compounds. Final report, June 31, 1990–December 31, 1994.** Sandhu, S.S. Claflin Coll., Orangeburg, SC (United States). 31 Dec 1994. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-90SR18159. Order Number DE95014967. Source: OSTI; NTIS; GPO Dep.

Funds were received from the United States Department of Energy to study the effects of soil mineral phases on the rates of abiotic degradation of tetraphenylborate (TPB) and diphenylboronic acid (DPBA). In addition to kaolinite and montmorillonite clay minerals, the role of goethite, corundum, manganite, and rutile in the degradation of organoborates was also evaluated. The effects of DPBA, argon, molecular dioxygen (O_2), temperature, and organic matter on the degradation of organoborates were also measured. The results indicated that TPB and DPBA degraded rapidly on the mineral surfaces. The initial products generated from the degradation of TPB were DPBA and biphenyl; however, further degradation resulted in the formation of phenylboric acid and phenol which persisted even after TPB disappeared. The data also showed that the rate of TPB degradation was faster in kaolinite, a 1:1 clay mineral, than in montmorillonite, a double layer mineral. The initial degradation of TPB by corundum was much higher than goethite, manganite and rutile. However, no further degradation by this mineral was observed where as the degradation of TPB continued by goethite and rutile minerals. Over all, the degradation rate of TPB was the highest for goethite as compared to the other metal oxide minerals. The degradation of TPB and DPBA was a redox reaction where metals (Fe, Al, Ti, Mn) acted as Lewis acids. DPBA and argon retarded the TPB degradation where as molecular oxygen organic matter and temperature increased the rate of TPB disappearance.

24583 (ENEA-RT-AMB–93-20) **Dendrogeomorphology in landslide analysis: State of art.** Margottini, C. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Fantucci, R. ENEA, Casaccia (Italy). Area Energia Ambiente e Salute. Jan 1994. 24p. Order Number DE95789705. Source: OSTI; NTIS (US Sales Only).

This article summarizes the uses of dendrogeomorphological techniques in landslide analysis. It shows how to study different landslides events through the analysis of living trees. Living trees record any slope inclination variation as if they were natural inclinometers moreover they can be used to date landslide and their stabilization process with time.

24584 (ENEA-RT-AMB–94-30) **Climatic characters of tosco-emiliano apennines.** Fabozzi, C. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Naviglio, L.; Serra, F.; Michetti, L. ENEA, Rome (Italy). Area Energia Ambiente e Salute. Jan 1995. 37p. (In Italian). Order Number DE95789771. Source: OSTI; NTIS (US Sales Only).

The study deals with the principal climatic characters of the Tosco-Emiliano Apennines situated between Toscana and Emilia Romagna regions, according with altitude and topography. Ten weather stations, included in the districts of Bologna and Pistoia, are considered. Mean monthly temperatures and monthly rains from Second World War till now are studied. The use of multivariate programs and the application of bioclimatic index has allowed to define in the area four climatic clusters that correspond to different climatic typology. Moreover the vegetational variation of the area in the last forty years has been studied with the use of the existing cartography. The vegetation cover were correlated with the particular climatic trends of temperature and rains since the Second World War.

24585 (ETDE-DE–158) **Biological remediation of contaminated sites. Part project 1: development of microbiological/adsorptive methods for in-situ decontamination. Final report.** Schacht, S.; Sinder, C.; Kappernagel, T.; Pfeifer, F.; Klein, J. DMT-Gesellschaft fuer Forschung und Pruefung mbH, Essen (Germany). Inst. fuer Chemische Umwelttechnologie. May 1995. 123p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 1460521. Order Number DE95790216. Source: OSTI; NTIS (US Sales Only).

For in situ and on site treatment of PAH contaminated soils biotechnological methods were developed and applied. The selection of suitable areas for field experiments was investigated by sampling and hydrogeological investigations. Soil samples were characterized according to their degree of contamination as well as to their microbiological state. Laboratory investigations proved the degradability of PAH up to four condensed rings. For the determination of biodegradability of contaminants a laboratory test system was developed which gives reliable data for biodegradation, degradation rates and restconcentration of contaminated soils. For assessment of soil contaminations several biotests were applied and developed. For PAH contaminated soil analyses of soil eluates with a Microtox bioassay proved to be suitable. Toxicity of soil samples containing PAH could be monitored by microtox bioassay using soil eluates as test samples. Several reactor types for biotreatment of contaminated soil were tested in order to estimate an optimum degree of PAH removal from different types of soils. For the treatment of silty soils a hydraulic fludized bed reactor proved to be most suitable. (orig.)

24586 (FZKA–5521) **The continuous ammonia measurement in the ppb range in aired soil.** Weinlaender, A. Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Inst. fuer Radiochemie; Karlsruhe Univ. (T.H.) (Germany). Fakultaet fuer Chemie. Feb 1995. 142p. Order Number DE95795767. Source: OSTI; NTIS (US Sales Only).

The objective of this work was to find a possibility to measure the concentration of ammonia occuring during chemical processes in nature in the ppb range. Continuous measuring methods were applied in order to work as automated and fast as possible and to avoid measuring errors. The first part of the work deals with the systematic presentation of the current situation of ammonia measuring technology for this low concentration range. The information was gathered through extensive literary research as well as through test measurements and discussions with the relevant manufactures of measuring devices. The second part of the work was dedicated to the practical application of the measuring methods worked out in the first part to determine the NH_3 emission rate of soils. (orig.)

24587 (GFS–25/94) **The variability of the potential radiation exposure to man arising from radionuclides released to the ground water.** Proehl, G.; Mueller, H. GSF - Forschungszentrum fuer Umwelt und Gesundheit Neuherberg GmbH, Oberschleissheim (Germany). Inst. fuer Strahlenschutz. Dec 1994. 69p. Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 02E8019. Order Number DE95795720. Source: OSTI; NTIS (US Sales Only); INIS.

The variability of the potential radiation exposure of the population is estimated if radionuclides (Np-237, Tc-99, I-129, Cs-135, Ra-226, U-238) are released to the ground water which is used by man as drinking water for humans and animals, for irrigation of food and feed crops, and for the production of fish in freshwater bodies. Annual effective dose equivalents are calculated assuming a normalized activity concentration in the water of 1 Bq/l for each radionuclide considered. An important aim is the estimation of the uncertainty of the exposure due to the uncertainty and the variability of the input parameters. The estimated frequency distributions of the input parameters were used as a model input and processed with Latin Hypercube Sampling and a Monte-Carlo technique. This estimation is based on an exposure scenario which reflects the present conditions. The critical group for the exposure due to the use of contaminated ground water are for most radionuclides the children of 1 year, although the activity intake of children is much lower than for adults. However the ingestion dose factors for infants are higher; in many cases the differences are higher than a factor of 5. (orig./HP)

24588 (ITRI–145) **Inhalation Toxicology Research Institute Site Environmental report, 1994.** Inhalation Toxicology Research Inst., Albuquerque, NM (United States). May 1995. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76EV01013. Order Number DE95014378. Source: OSTI; NTIS; GPO Dep.

The Inhalation Toxicology Research Institute (ITRI) was constructed in 1960 with the initial purpose of studying human health hazards of inhaling airborne radioactive fission products; its scope was broadened to cover other airborne materials. ITRI has in place an extensive radiological and nonradiological environmental monitoring program which monitors air emissions, groundwater, soil and ambient air around the facility. ITRI is in compliance with air quality and hazardous waste regulations; however, sewage lagoons remain from previous operations. Remediation activities have been begun or are scheduled to begin on these lagoons and on low-level radioactive liquid waste evaporation ponds. Except for the issues mentioned, ITRI is in compliance with all other federal, state, and local regulations.

24589 (JAERI-Tech–94-032) **Physical model simulation for resistivity tomography. An experimental tank and detection limit for a pole-pole array.** Kumata, Masahiro (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Ii, Hiroyuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Nov 1994. 59p. (In Japanese). Order Number DE95789466. Source: OSTI; NTIS; INIS.

Underground hydrology is one of important items for the assessment of the high-level radioactive waste disposal. Rock fractures play an important role in local hydrology in fractured rock mass. In order to develop the technique of rock fracture survey, basic study on resistivity tomography has been carried out using an experimental tank 2x2m square and 2.2m in depth. The tank was filled with a NaCl solution to represent a homogeneous geologic media. A multi-electrode representing electrodes that will be arranged in field was used in the tank for a physical model simulation with 4 different sized fracture models. The detection limit of the resistivity tomography using a pole-pole array was discussed based on the results of both the physical and numerical model simulations. (author) 60 refs.

24590 (K/NSP–274) **IAEA workshop and field trial at the Oak Ridge K-25 Site.** Hembree, D.M. Jr.; Ross, H.H.; Carter, J.A. Oak Ridge K-25 Site, TN (United States). Mar 1995. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE95011838. Source: OSTI; NTIS; INIS; GPO Dep.

In March 1994, members of the International Safeguards Department in the National Security Program Office (NSPO) hosted an environmental monitoring field trial workshop for International Atomic Energy Agency (IAEA) inspectors. The workshop was held at the Oak Ridge K-25 Site and its primary purpose was to train the inspectors in the techniques needed for effective environmental sample collection and handling. The workshop emphasized both sampling theory and practice. First, detailed techniques for swipe, vegetation, soil, biota, and water-associated sampling were covered in the classroom. Subsequently, the inspectors were divided into three groups for actual sample collection in and around the K-25 locale. The collected samples were processed by the Department of Energy (DOE) Network of Analytical Laboratories using established analytical techniques. This activity is part of the IAEA "Programme 93+2 in. assessment of measures to enhance IAEA safeguards.

24591 (K/NSP–275) **Environmental monitoring for detection of uranium enrichment operations: Comparison of LEU and HEU facilities.** Hembree, D.M. Jr.; Carter, J.A.; Ross, H.H. Oak Ridge Y-12 Plant, TN (United States). Mar 1995. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE95010929. Source: OSTI; NTIS; INIS; GPO Dep.

In 1994, the International Atomic Energy Agency (IAEA) initiated an ambitious program of worldwide field trials to evaluate the utility of environmental monitoring for safeguards. Part of this program involved two extensive United States field trials conducted at the large uranium enrichment facilities. The Paducah operation involves a large low-enriched uranium (LEU) gaseous diffusion plant while the Portsmouth facilities include a large gaseous diffusion plant that has produced both LEU and high-enriched uranium (HEU) as well as an LEU centrifuge facility. As a result of the Energy Policy Act of 1992, management of the uranium enrichment operations was assumed by the US Enrichment Corporation (USEC). The facilities are operated under contract by Martin Marietta Utility Services. Martin Marietta Energy Systems manages the environmental restoration and waste management programs at Portsmouth and Paducah for DOE. These field trials were conducted. Samples

included swipes from inside and outside process buildings, vegetation and soil samples taken from locations up to 8 km from main sites, and hydrologic samples taken on the sites and at varying distances from the sites. Analytical results from bulk analysis were obtained using high abundance sensitivity thermal ionization mm spectrometers (TIMS). Uranium isotopics altered from the normal background percentages were found for all the sample types listed above, even on vegetation 5 km from one of the enrichment facilities. The results from these field trials demonstrate that dilution by natural background uranium does not remove from environmental samples the distinctive signatures that are characteristic of enrichment operations. Data from swipe samples taken within the enrichment facilities were particularly revealing. Particulate analysis of these swipes provided a detailed "history" of both facilities, including the assays of the end product and tails for both facilities.

24592 (LA-SUB–95-27-3) **SAMFT3D: Single-phase and multiphase flow and transport in 3 dimensions. Version 1.0, Documentation and user's guide.** Los Alamos National Lab., NM (United States); HydroGeoLogic, Inc., Herndon, VA (United States). Sep 1991. 190p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95013054. Source: OSTI; NTIS; GPO Dep.

SAMFT3D is a three-dimensional, finite element code designed to simulate single-phase and multiphase fluid flow and contaminant transport in porous media. This report documents the single-phase version of the code. The single-phase computational modules have been developed to simulate flow and solute transport in fully or variable saturated porous media. The formulation of the governing equations and the numerical procedures used in these modules are presented. The flow equation is approximated using the Galerkin finite element method. For variably saturated flow problems, nonlinearities due to unsaturated soil properties are treated using Picard or Newton-Raphson iterations. The contaminant transport simulation can account for advection, hydrodynamic dispersion, linear equilibrium sorption, and first-order degradation. Transport of a single component can be handled. The transport equation is approximated using a upstream weighted residual method. Several test problems are presented to verify the code and to demonstrate its utility. These problems range from single one-dimensional to complex three-dimensional problems. This document has been produced as a user's manual. It contains brief information on the code structure along with detailed instructions for input data preparation and sample input and printed output for selected test problems. Also included are instructions for setting up a simulation run and restart procedures.

24593 (LA-SUB–95-93) **Characterization of vegetation properties: Canopy modeling of pinyon-juniper and ponderosa pine woodlands; Final report. Modeling topographic influences on solar radiation: A manual for the SOLARFLUX model.** Rich, P.M.; Hetrick, W.A.; Saving, S.C. Los Alamos National Lab., NM (United States); Kansas Univ., Lawrence, KS (United States). 1994. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95014560. Source: OSTI; NTIS; GPO Dep.

This report is comprised of two studies. The first study focuses on plant canopies in pinyon-juniper woodland, ponderosa pine woodland, and waste sites at Los Alamos National Laboratory which involved five basic areas of research: (1) application of hemispherical photography and other gap fraction techniques to study solar radiation regimes and canopy architecture, coupled with application of time-domain reflectometry to study soil moisture; (2) detailed characterization of canopy architecture using stand mapping and allometry; (3) development of an integrated geographical information system (GIS) database for relating canopy architecture with ecological, hydrological, and system modeling approaches; (4) development of geometric models that simulate complex sky obstruction, incoming solar radiation for complex topographic surfaces, and the coupling of incoming solar radiation with energy and water balance, with simulations of incoming solar radiation for selected native vegetation and experimental waste cover design sites; and (5) evaluation of the strengths and limitations of the various field sampling techniques. The second study describes an approach to develop software that takes advantage of new generation computers to model insolation on complex topographic surfaces. SOLARFLUX is a GIS-based (ARC/INFO, GRID) computer program that models incoming solar radiation based on surface orientation (slope and aspect), solar angle (azimuth and zenith) as it shifts over time, shadows caused by topographic features, and atmospheric conditions. This manual serves as the comprehensive guide to SOLARFLUX. Included are discussions on modelling insolation on complex surfaces, the theoretical approach, program setup and operation, and a set of applications illustrating characteristics of topographic insolation modelling.

24594 (LBL–36400) **T2VOC user's guide.** Falta, R.W. (Clemson Univ., Clemson, SC (United States). Dept. of Earth Sciences); Pruess, K.; Finsterle, S.; Battistelli, A. Lawrence Berkeley Lab., CA (United States). Mar 1995. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95015144. Source: OSTI; NTIS; GPO Dep.

T2VOC is a numerical simulator for three-phase, three-component, non-isothermal flow of water, air, and a volatile organic compound (VOC) in multidimensional heterogeneous porous media. Developed at the Lawrence Berkeley Laboratory, T2VOC is an extension of the TOUGH2 general-purpose simulation program. This report is a self-contained guide to application of T2VOC to subsurface contamination problems involving nonaqueous phase liquids (NAPLs). It gives a technical description of the T2VOC code, including a discussion of the physical processes modeled, and the mathematical and numerical methods used. Detailed instructions for preparing input data are presented along with several illustrative sample problems.

24595 (NUREG–0837-Vol.15-No.1) **NRC TLD Direct Radiation Monitoring Network: Volume 15, No. 1. Progress report, January–March 1995.** Struckmeyer, R. Nuclear Regulatory Commission, King of Prussia, PA (United States). Region I. May 1995. 229p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This report provides the status and results of the NRC Thermoluminescent Dosimeter (TLD) Direct Radiation Monitoring Network. It presents the radiation levels measured in the vicinity of NRC licensed facilities throughout the country for the first quarter of 1995.

24596 (ORNL/RASA–95/4) **Radiological verification survey results at 3 Peck Ave., Pequannock, New Jersey (PJ002V).** Rodriguez, R.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014468. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) conducted remedial action during 1993 at the Pompton Plains Railroad Spur and eight vicinity properties in the Wayne and Pequannock Townships in New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W.R. Grace facility. The property at 3 Peck Ave., Pequannock, New Jersey is one of these vicinity properties. At the request of DOE, a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at this property. The purpose of the survey, conducted between September and December 1993, was to confirm the success of the remedial actions performed to remove any radioactive materials in excess of the identified guidelines. The verification survey included surface gamma scans and gamma readings at 1 meter, beta-gamma scans, and the collection of soil and debris samples for radionuclide analysis. Results of the survey demonstrated that all radiological measurements on the property at 3 Peck Ave. were within applicable DOE guidelines. Based on the results of the remedial action data and confirmed by the verification survey data, the portions of the site that had been remediated during this action successfully meet the DOE remedial action objectives.

24597 (ORNL/RASA–95/5) **Radiological verification survey results at 7 Peck Ave., Pequannock, New Jersey (PJ003V).** Rodriguez, R.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract AC05-84OR21400. Order Number DE95014469. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) conducted remedial action during 1993 at the Pompton Plains Railroad Spur and eight vicinity properties in the Wayne and Pequannock Townships in New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W.R. Grace facility. The property at 7 Peck Ave., Pequannock, New Jersey is one of these vicinity properties. At the request of DOE, a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at this property. The purpose of the survey, conducted between September and December 1993, was to confirm the success of the remedial actions performed to remove any radioactive materials in excess of the identified guidelines. The verification survey included surface gamma scans and gamma readings at 1 meter, beta-gamma scans, and the collection of soil samples for radionuclide analysis. Results of the survey demonstrated that all radiological measurements on the property at 7 Peck Ave. were within applicable DOE guidelines. Based on the results of the remedial action data and confirmed by the verification survey data, the portions of the site that had been remediated during this action successfully meet the DOE remedial action objectives.

24598 (ORNL/RASA–95/6) **Radiological verification survey results as 13 Peck Ave., Pequannock, New Jersey (PJ004V).** Rodriguez, R.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014470. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) conducted remedial action during 1993 at the Pompton Plains Railroad Spur and eight vicinity properties in the Wayne and Pequannock Townships in New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W.R. Grace facility. The property at 13 Peck Ave., Pequannock, New Jersey is one of these vicinity properties. At the request of DOE, a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at this property. The purpose of the survey, conducted between September and December 1993, was to confirm the success of the remedial actions performed to remove any radioactive materials in excess of the identified guidelines. The verification survey included surface gamma scans and gamma readings at 1 meter, beta-gamma scans, and the collection of soil and debris samples for radionuclide analysis. Results of the survey demonstrated that all radiological measurements on the property at 13 Peck Ave. were within applicable DOE guidelines. Based on the results of the remedial action data and confirmed by the verification survey data, the portions of the site that had been remediated during this action successfully meet the DOE remedial action objectives.

24599 (ORNL/RASA–95/7) **Radiological verification survey results at 17 Peck Ave., Pequannock, New Jersey (PJ006V).** Rodriguez, R.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014471. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) conducted remedial action during 1993 at the Pompton Plains Railroad Spur and eight vicinity properties in the Wayne and Pequannock Townships in New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W.R. Grace facility. The property at 17 Peck Ave., Pequannock, New Jersey is one of these vicinity properties. At the request of DOE, a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at this property. The purpose of the survey, conducted between September and December 1993, was to confirm the success of the remedial actions performed to remove any radioactive materials in excess of the identified guidelines. The verification survey included surface gamma scans and gamma readings at 1 meter, beta-gamma scans, and the collection of soil and debris samples for radionuclide analysis. Results of the survey demonstrated that all radiological measurements on the property at 17 Peck Ave. were within applicable DOE guidelines. Based on the results of the remedial action data and confirmed by the verification survey data, the portions of the site that had been remediated during this action successfully meet the DOE remedial action objectives.

24600 (ORNL/RASA–95/8) **Radiological verification survey results at 898 Black Oak Ridge Rd., Wayne, New Jersey (WJ004V).** Rodriguez, R.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). May 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014472. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) conducted remedial action during 1993 at the Pompton Plains Railroad Spur and eight vicinity properties in the Wayne and Pequannock Townships in New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W.R. Grace facility. The property at 898 Black Oak Ridge Road, Wayne, New Jersey is one of these vicinity properties. At the request of DOE, a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at this property. The purpose of the survey, conducted between September and December 1993, was to confirm the success of the remedial actions performed to remove any radioactive materials in excess of the identified guidelines. The verification survey included surface gamma scans and gamma readings at one meter, beta-gamma scans, and the collection of soil and debris samples for radionuclide analysis. Results of the survey demonstrated that all radiological measurements on the property at 898 Black Oak Ridge Road were within applicable DOE guidelines. Based on the results of the remedial action data and confirmed by the verification survey data, the portions of the site that had been remediated during this action successfully meet the DOE remedial action objectives.

24601 (ORNL/RASA–95/9) **Radiological survey results at 914 Black Oak Ridge Road, Wayne, New Jersey (WJ005).** Rodriguez, R.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014473. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) conducted remedial action during 1993 at several vicinity properties in the Wayne and Pequannock Townships in New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W.R. Grace facility. The property at 914 Black Oak Ridge Road, Wayne, New Jersey was not one of these vicinity properties; however the owner requested that his property be radiologically surveyed. At the request of DOE, a team from Oak Ridge National Laboratory conducted a radiological scoping survey of this property. The purpose of the survey, conducted in early November 1993, was to determine whether any radiological contamination might be present on the property. The radiological survey included surface gamma scans and gamma readings at one meter, and the collection of soil and/or debris samples for radionuclide analysis. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of applicable DOE guidelines.

24602 (ORNL/RASA–95/10) **Radiological verification survey results at the Pompton Plains Railroad Spur, Pequannock, New Jersey (PJ008V).** Rodriguez, R.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). May 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014474. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) conducted remedial action during 1993 at the Pompton Plains railroad spur and eight vicinity properties in the Wayne and Pequannock Townships in New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W.R. Grace facility. The property at the Pompton Plains Railroad Spur, Pequannock, New Jersey is one of these vicinity properties. At the request of DOE, a team from Oak Ridge National Laboratory conducted an

independent radiological verification survey at this property. The purpose of the survey, conducted between September and December 1993, was to confirm the success of the remedial actions performed to remove any radioactive materials in excess of the identified guidelines. The verification survey included surface gamma scans and gamma readings at 1 meter, beta-gamma scans, and the collection of soil and debris samples for radionuclide analysis. Results of the survey demonstrated that all radiological measurements on the property at the Pompton Plains railroad spur were within applicable DOE guidelines. Based on the results of the remedial action data and confirmed by the verification survey data, the portions of the site that had been remediated during this action successfully meet the DOE remedial action objectives.

24603 (ORNL/RASA–95/11) **Radiological verification survey results at 15 Peck Ave., Pequannock, New Jersey (PJ005V).** Rodriguez, R.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014475. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) conducted remedial action during 1993 at the Pompton Plains Railroad Spur and eight vicinity properties in the Wayne and Pequannock Townships in New Jersey as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). These properties are in the vicinity of the DOE-owned Wayne Interim Storage Site (WISS), formerly the W.R. Grace facility. The property at 15 Peck Ave., Pequannock, New Jersey is one of these vicinity properties. At the request of DOE, a team from Oak Ridge National Laboratory conducted an independent radiological verification survey at this property. The purpose of the survey, conducted between September and December 1993, was to confirm the success of the remedial actions performed to remove any radioactive materials in excess of the identified guidelines. The verification survey included surface gamma scans and gamma readings at 1 meter, beta-gamma scans, and the collection of soil and debris samples for radionuclide analysis. Results of the survey demonstrated that all radiological measurements on the property at 15 Peck Ave. were within applicable DOE guidelines. Based on the results of the remedial action data and confirmed by the verification survey data, the portions of the site that had been remediated during this action successfully meet the DOE remedial action objectives.

24604 Removal of radioactive materials and heavy metals form water using magnetic resin. Kochen, R.L. (EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant); Navratil, J.D. 1993. Filed date 7 May 1993. U.S. Patent Application 8-062,512. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP03533 ; AC34-90RF62349. Order Number DE95015048. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Magnetic polymer resins capable of efficient removal of actinides and heavy metals from contaminated water are disclosed together with methods for making, using, and regenerating them. The resins comprise polyamine-epichlorohydrin resin beads with ferrites attached to the surfaces of the beads. Markedly improved water decontamination is demonstrated using these magnetic polymer resins of the invention in the presence of a magnetic field, as compared with water decontamination methods employing ordinary ion exchange resins or ferrites taken separately.

24605 (PNL–10608) **Risk information in support of cost estimates for the Baseline Environmental Management Report (BEMR). Section 1.** Gelston, G.M. (Pacific Northwest Lab., Richland, WA (United States)); Jarvis, M.F.; Warren, B.R.; Von Berg, R. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 302p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015593. Source: OSTI; NTIS; INIS; GPO Dep.

The Pacific Northwest Laboratory (PNL)(1) effort on the overall Baseline Environmental Management Report (BEMR) project consists of four installation-specific work components performed in succession. These components include (1) development of source terms, 92) collection of data and preparation of environmental settings reports, (3) calculation of unit risk factors, and (4) utilization of the unit risk factors in Automated Remedial Action Methodology (ARAM) for computation of target concentrations and cost estimates. This report documents work completed for the Nevada Test Site, Nevada, for components 2 and 3. The product of this phase of the BEMR project is the development of unit factors (i.e., unit transport factors, unit exposure factors, and unit risk factors). Thousands of these unit factors are gene rated and fill approximately one megabyte of computer information per installation. The final unit risk factors (URF) are transmitted electronically to BEMR-Cost task personnel as input to a computer program (ARAM). Abstracted files and exhibits of the URF information are included in this report. These visual formats are intended to provide a sample of the final task deliverable (the URF files) which can be easily read without a computer.

24606 (PNL–10633) **Geologic, geochemical, microbiologic, and hydrologic characterization at the In Situ Redox Manipulation Test Site.** Vermeul, V.R. (and others); Teel, S.S.; Amonette, J.E. Pacific Northwest Lab., Richland, WA (United States). Jul 1995. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015839. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents results from characterization activities at the In Situ Redox Manipulation (ISRM) Field Test Site which is located within the 100-HR-3 Operable Unit of the US Department of Energy's (DOE's) Hanford Site in Richland, Washington. Information obtained during hydrogeologic characterization of the site included sediment physical properties, geochemical properties, microbiologic population data, and aquifer hydraulic properties. The purpose of obtaining this information was to improve the conceptual understanding of the hydrogeology beneath the ISRM test site and provide detailed, site specific hydrogeologic parameter estimates. The resulting characterization data will be incorporated into a numerical model developed to simulate the physical and chemical processes associated with the field experiment and aid in experiment design and interpretation.

24607 (PNL-SA–25640) **Effect of temperature on perchloroethylene dechlorination by a methanogenic consortium.** Gao, J.; Skeen, R.S.; Hooker, B.S. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950483–3: 3. international symposium on in situ and on-site bioreclamation, San Diego, CA (United States), 24-27 Apr 1995). Order Number DE95014168. Source: OSTI; NTIS; GPO Dep.

The effect of temperature on the kinetics of growth, substrate metabolism, and perchloroethylene (PCE) dechlorination by a methanogenic consortium is reported. In all cases, a simple kinetic model accurately reflected experimental data. Values for the substrate and methane yield coefficients, and the maximum specific growth rate are fairly consistent at each temperature. Also, the substrate and methane yield coefficients show little temperature sensitivity. In contrast, both the maximum specific growth rate and the PCE dechlorination yield coefficient (Y_{PCE}) are temperature dependent.

24608 (PNL-SA–25678) **The use of bench- and field-scale data for design of an in situ carbon tetrachloride bioremediation system.** Peyton, B.M. (and others); Truex, M.J.; Skeen, R.S. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950483–5: 3. international symposium on in situ and on-site bioreclamation, San Diego, CA (United States), 24-27 Apr 1995). Order Number DE95014194. Source: OSTI; NTIS; INIS; GPO Dep.

A suite of simulation models were developed as a design tool in support of an in situ bioremediation demonstration at the Hanford site in Washington state. The design tool, calibrated with field - and bench-scale data, was used to answer four field-scale system design questions: (1) What are the important reaction processes and kinetics? (2) How will biomass distribute in the aquifer in response to injected substrate? (3) What well configuration best ensures proper nutrient transport and process control? (4) What operating and monitoring strategy should be used to confirm effective remediation? This paper does not describe the design tool itself, but describes how the design tool was used to optimize field site

design parameters such as well spacing, hydraulic control, contaminant destruction, and nutrient injection strategies.

24609 (PNL-SA–25679) **Modeling biologically reactive transport in porous media.** Clement, T.P.; Hooker, B.S.; Skeen, R.S. Pacific Northwest Lab., Richland, WA (United States); Associated Western Universities, Inc., Salt Lake City, UT (United States). Apr 1995. 10p. Sponsored by USDOE, Washington, DC (United States);Associated Western Universities, Inc., Salt Lake City, UT (United States). DOE Contract AC06-76RL01830 ; FG07-93ER75912. (CONF-950420–27: International conference on mathematics and computations, reactor physics, and environmental analyses, Portland, OR (United States), 30 Apr - 4 may 1995). Order Number DE95014195. Source: OSTI; NTIS; INIS; GPO Dep.

A one-dimensional biofilm-based reactive transport model is developed to simulate biologically mediated substrate metabolism and contaminant destruction in saturated porous media. The resulting equations are solved by a finite-difference based, three-level, operator-split approach. The numerical solution procedure is stable, easy-to-code, and computationally efficient. As an example problem, biological denitrification and fortuitous CT destruction processes in one-dimensional porous media is studied. The simulation results of the example problem show that the present model can be successfully used to predict biological processes and nutrient/contaminant transport in saturated porous media.

24610 (SAND–94-0323C) **Detailed characterization and preliminary adsorption model for materials for an intermediate-scale reactive-transport experiment.** Ward, D.B. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Earth and Planetary Sciences); Bryan, C.R.; Siegel, M.D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940553–84: International high-level radioactive waste management conference, Las Vegas, NV (United States), 22-26 May 1994). Order Number DE95014216. Source: OSTI; NTIS; INIS; GPO Dep.

An experiment involving migration of fluid and tracers (Li, Br, Ni) through a 6-m-high x 3-m-dia caisson Wedron 510 sand, is being carried out for Yucca Mountain Site Characterization Project. Sand's surface chemistry of the sand was studied and a preliminary surface-complexation model of Ni adsorption formulated for transport calculations. XPS and leaching suggest that surface of the quartz sand is partially covered by thin layers of Fe-oxyhydroxide and Ca-Mg carbonate and by flakes of kaolinite. Ni adsorption by the sand is strongly pH-dependent, showing no adsorption at pH 5 and near-total adsorption at pH 7. Location of adsorption edge is independent of ionic strength and dissolved Ni concentration; it is shifted to slightly lower pH with higher pCO2 and to slightly higher pH by competition with Li. Diminished adsorption at alkiline pH with higher pCO2 implies formation of dissolved Ni-carbonato complexes. Ni adsorption edges for goethite and quartz, two components of the sand were also measured. Ni adsorption on pure quartz is only moderately pH-dependent and differs in shape and location from that of the sand, whereas Ni adsorption by goethite is strongly pH-dependent. A triple-layer surface-complexation model developed for goethite provides a good fit to the Ni-adsorption curve of the sand. Based on this model, the apparent surface area of the Fe-oxyhydroxide coating is estimated to be 560 m^2/g, compatible with its occurrence as amorphous Fe-oxyhydroxide. Potentiometric titrations on sand also differ from pure quartz and suggest that effective surface area of sand may be much greater than that measured by N_2-BET gas adsorption. Attempts to model the adsorption of bulk sand in terms of properties of pure end member components suggest that much of the sand surface is inert. Although the exact Ni adsorption mechanisms remain ambiguous, this preliminary adsorption model provides an initial set of parameters that can be used in transport calculations.

24611 (SAND–95-1084C) **Modeling of capillary barriers and comparison to data.** Webb, S.W.; Stormont, J.C. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9503116–11: 1995 TOUGH workshop, Berkeley, CA (United States), 20-22 Mar 1995). Order Number DE95013027. Source: OSTI; NTIS; GPO Dep.

Measurements of capillary barrier performance have been conducted in above-grade wooden structures (boxes) configured to measure the water balance. The capillary-barrier portion of the boxes is 6.0 m long, 2.0 m wide, and 1.2 m high with a slope of 5%. A coarse-grained material was placed in the bottom 25-cm of the box with a 90-cm deep fine-grained material (local soil) on top. A region for laterally diverted water to accumulate and drain was created in the last 1.0 m of the box. The soil at the top is terraced into five, 1.4 m long, level intervals to prevent runoff when adding water. Water is added uniformly to the entire top of the box at a rate of about 66 l/day, or an infiltration rate of 1.7 m/year. The top of the box is covered with fiber-reinforced plastic to minimize evaporation of water, discourage plant growth, and prevent rainfall from contacting the soil. Five drains are spaced along the bottom of the coarse layer. These drains discretize the coarse layer into five collection regions to provide a means of identifying the breakthrough location into the coarse layer. A drain is also located in the downdip collection region of the box. Soil moisture changes were measured in the fine-grained material with a frequency-domain reflectometry (FDR) probe, which was calibrated using soil from the field site at a known moisture content and density.

24612 (UCRL-ID–106132-Rev.1) **Environmental monitoring plan - environmental monitoring section. Revision 1.** Wilt, G.C. (ed.) (and others); Tate, P.J.; Brigdon, S.L. Lawrence Livermore National Lab., CA (United States). Nov 1994. 372p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014137. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the environmental monitoring plan for the Lawrence Livermore National Laboratory. A site characterization is provided along with monitoring and measurement techniques and quality assurance measures.

24613 (UCRL-ID–120321) **Compilation of data for isotope mapping of groundwater in the Central Valley of California, 1993-1995.** Davisson, M.L. (Lawrence Livermore National Lab., CA (United States)); Criss, R.E.; Campbell, K.R. Lawrence Livermore National Lab., CA (United States). May 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015131. Source: OSTI; NTIS; INIS; GPO Dep.

A major stable isotope mapping project is underway that will provide important baseline information to the State of California in management of their groundwater resources. The results represent a new technological application using isotope hydrology to better understand and predict the sustainability of California's groundwater supply for the future. This project is driven by the fact that Californians inhabit a semi-arid region of seasonal precipitation, but have created a lifestyle and economic infrastructure requiring a sub-tropical climate. They have accomplished this by engineering systems that store and divert alpine runoff, and by utilizing a large, productive alluvial aquifer. In the past, both of these resources appeared to be unlimited. Today, water shortages are recognized, regardless of drought conditions. Because Californians maintain their current practices of prolific water use, the deep-seated competition between agricultural users and urban consumers has been amplified. This has been aggravated by the acquisition of one-third of the available surface water resources for maintenance of aquatic habitats. The State of California accepts and encourages the use of groundwater to supplement these diverse water demands. Stable isotope imaging of the groundwater resources has proven to be the most economical and effective means to diagnose the health of the giant alluvial aquifer of the Central Valley. Augmented by radiocarbon analysis and nitrate determinations, stable isotope data can be used to clearly distinguish groundwater recharged from natural or anthropogenic sources. Isotope maps delineate (1) the geographic distribution of various groundwater masses and of preferential recharge zones, (2) the sources and extent of non-point source pollution, and (3) the locations and rates of lateral flow channels. Different recharge rates of natural and modern groundwater bodies can be used to characterize safe yield parameters for aquifers.

24614 (UCRL-ID–120322) **Uncertainties associated with the definition of a hydrologic source term for the Nevada Test Site.** Smith, D.K. (Lawrence Livermore National Lab., CA (United

States)); Esser, B.K.; Thompson, J.L. Lawrence Livermore National Lab., CA (United States). May 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015130. Source: OSTI; NTIS; GPO Dep.

The U.S. Department of Energy, Nevada Operations Office (DOE/NV) Environmental Restoration Division is seeking to evaluate groundwater contamination resulting from 30 years of underground nuclear testing at the Nevada Test Site (NTS). This evaluation requires knowledge about what radioactive materials are in the groundwater and how they are transported through the underground environment. This information coupled with models of groundwater flow (flow paths and flow rates) will enable predictions of the arrival of each radionuclide at a selected receptor site. Risk assessment models will then be used to calculate the expected environmental and human doses. The accuracy of our predictions depends on the validity of our hydrologic and risk assessment models and on the quality of the data for radionuclide concentrations in ground water at each underground nuclear test site. This paper summarizes what we currently know about radioactive material in NTS groundwater and suggests how we can best use our limited knowledge to proceed with initial modeling efforts. The amount of a radionuclide available for transport in groundwater at the site of an underground nuclear test is called the hydrologic source term. The radiologic source term is the total amount of residual radionuclides remaining after an underground nuclear test. The hydrologic source term is smaller than the radiologic source term because some or most of the radionuclide residual cannot be transported by groundwater. The radiologic source term has been determined for each of the underground nuclear tests fired at the NTS; however, the hydrologic source term has been estimated from measurements at only a few sites.

24615 (WSRC-MS–94-0528) **Uranium partitioning under acidic conditions in a sandy soil aquifer.** Johnson, W.H. (Westinghouse Savannah River Co., Aiken, SC (United States). Savannah River Technology Center); Serkiz, S.M.; Johnson, L.M. Westinghouse Savannah River Co., Aiken, SC (United States); Georgia Inst. of Tech., Atlanta, GA (United States). School of Mechanical Engineering. [1995]. 15p. Sponsored by USDOE, Washington, DC (United States);Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC09-89SR18035 ; AC09-76SR00819. (CONF-950216–152: Waste management '95, Tucson, AZ (United States), 26 Feb - 2 mar 1995). Order Number DE95014728. Source: OSTI; NTIS; INIS; GPO Dep.

The partitioning of uranium in an aquifer down gradient of two large mixed waste sites was examined with respect to the solution and soil chemistry (e.g., pH redox potential and contaminant concentration) and aqueous-phase chemical speciation. This involved generation of field-derived, batch sorption, and reactive mineral surface sorption data. Field-derived distribution coefficients for uranium at these waste sites were found to vary between 0.40 and 15,000. Based on thermodynamic speciation modeling and a comparison of field and laboratory data, gibbsite is a potential reactive mineral surface present in modified soils at the sites. Uranium partitioning data are presented from field samples and laboratory studies of background soil and the mineral surface gibbsite. Mechanistic and empirical sorption models fit to the field-derived uranium partitioning data show an improvement of over two orders of magnitude, as measured by the normalized sum of errors squared, when compared with the single K_d model used in previous risk work. Models fit to batch sorption data provided a better fit of sorbed uranium than do models fit to the field-derived data.

24616 (WSRC-MS–95-0187) **The Speciation of Groundwater Contaminated with Coal Pile Leachate at the Savannah River Site, South Carolina.** Denham, M.E.; Nichols, R.L. Westinghouse Savannah River Co., Aiken, SC (United States). 15 May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9506198–1: International Association of Hydro-Geologists Congress: solutions, Edmonton (Canada), 4-10 Jun 1995). Order Number DE95060146. Source: OSTI; NTIS; INIS; GPO Dep.

Modeling the transport of contaminant metals and designing systems for their remediation requires an understanding of the metal's speciation. Thus, analysis of contaminant speciation and evaluation of the processes that can change the speciation should be done during characterization of the contaminated site. This approach is being used at the Savannah River Site for a metals contaminated site that will serve as a test platform for metals remediation technologies. The site is adjacent to a coal storage pile and the basin that contains the coal pile runoff. A network of well clusters allows definition of the plume, including profiles of contamination with depth. The groundwater is acidic (pH $\approx$ 2) and contains high concentrations of sulfate (up to 2300 mg/l) and metals, with chromium, nickel, cadmium and lead exceeding drinking water standards. Aluminum and total iron concentrations range up to 1326 mg/l and 7991 mg/l, respectively. Speciation calculations on dissolved contaminants indicate that as much as 65% of the lead, 54% of the cadmium, and 34% of the nickel may be present in sulfate complexes. Chromium occurs predominantly as Cr^{+3}. There is evidence that some contaminant metals may be associated with colloidal material. Contamination in the groundwater is stratified with concentrations decreasing over a depth range of 3 meters (10 feet). Fluid-rock interactions explain the non-uniform behavior of dissolved components with depth. Mass balance considerations suggest that the interactions are dominated by Kaolinite dissolution coupled with precipitation of phases containing aluminum, ferric iron, silica, and sulfate, as well as co- precipitation of contaminant metals.

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Refer also to citation(s) 23096, 23105, 23450, 23453, 23454, 23456, 23457, 23459, 23460, 23461, 23462, 23495, 23708, 24065, 24303, 24458, 24459, 24490, 24503, 24510, 24517, 24518, 24567, 24590, 24591, 24595, 24710, 24711, 24750, 24987

24617 (BNL–61801) **Gas mass transfer for stratified flows.** Duffey, R.B. (Brookhaven National Lab., Upton, NY (United States)); Hughes, E.D. EG and G Idaho, Inc., Idaho Falls, ID (United States); Brookhaven National Lab., Upton, NY (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570 ; AC02-76CH00016. (CONF-950853–5: ASME/JSME annual summer meeting of the Fluids Engineering conference, Hilton Head, SC (United States), 13-17 Aug 1995). Order Number DE95013511. Source: OSTI; NTIS; INIS; GPO Dep.

We analyzed gas absorption and release in water bodies using existing surface renewal theory. We show a new relation between turbulent momentum and mass transfer from gas to water, including the effects of waves and wave roughness, by evaluating the equilibrium integral turbulent dissipation due to energy transfer to the water from the wind. Using Kolmogoroff turbulence arguments the gas transfer velocity, or mass transfer coefficient, is then naturally and straightforwardly obtained as a non-linear function of the wind speed drag coefficient and the square root of the molecular diffusion coefficient. In dimensionless form, the theory predicts the turbulent Sherwood number to be $Sh_t = (2/\sqrt{\pi})Sc^{1/2}$, where Sh_t is based on an integral dissipation length scale in the air. The theory confirms the observed nonlinear variation of the mass transfer coefficient as a function of the wind speed; gives the correct transition with turbulence-centered models for smooth surfaces at low speeds; and predicts experimental data from both laboratory and environmental measurements within the data scatter. The differences between the available laboratory and field data measurements are due to the large differences in the drag coefficient between wind tunnels and oceans. The results also imply that the effect of direct aeration due to bubble entrainment at wave breaking is no more than a 20% increase in the mass transfer for the highest speeds. The theory has importance to mass transfer in both the geo-physical and chemical engineering literature.

24618 (BNL–61827) **Basic programs for the CO_2 system in seawater.** Lewis, E.R.; Wallace, D.W.R. Brookhaven National Lab., Upton, NY (United States). May 1995. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95013314. Source: OSTI; NTIS; GPO Dep.

The CO_2 system in seawater is characterized by four measurable parameters: TA, the total alkalinity; TC, the total (inorganic)

CO_2 (the sum of the dissolved CO_2, the carbonate, and the bicarbonate); pH; and either fCO_2, the fugacity of CO_2, or xCO_2, the mole fraction of CO_2 in air. Ta and TC are independent of temperature; fCO_2, xCO_2, and pH are not. The knowledge of any two of these parameters, along with the temperature, the salinity, the abundances of other constituents of seawater, and the relevant equilibrium constants, allows the determination of the other two. There are four programs in this package: CO2SYSTM.EXE; FCO2TCO2.EXE; PHTCO2.EXE; CO2BTCH.EXE. They are designed to be run on any 80 x 86 computer equipped with the DOS operating system. They are run simply by typing the program name from the command line. All input data for these programs should be in micromoles per kilogram of solution (μmol/kg-soln), microatmospheres (μatm) in the case of fCO_2, and parts per million (ppm) in the case of xCO_2. The pH should be on the total scale. All outputs are in these units also. Each program in this package allows a choice from the four sets of constants K_1 and K_2: those of Roy et al., Goyet and Poisson, Hansson and Mehrbach et al.

24619 (CONF-940277–, pp. 55-58) **Special working session on the role of buoy observations in the tropical Western Pacific measurement scheme.** Downing, J. (Marine Sciences Lab., Sequim, WA (United States)); Reynolds, R.M. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The purpose of this session was to discuss the scientific merits of retrofitting TOGA/TAO buoys with shortwave radiometers. Three questions were posed at the outset to focus the discussion: Does the ARM Program need widespread radiometric measurements in the Tropical Western Pacific (TWP) locale to augment the five Atmospheric Radiation and Cloud Stations and future ocean sites already planned; If there is a need, can buoy-based radiometers with satellites and other measurement platforms provide useful data; If buoy-based radiometric measurements were made, who would use them?

24620 (CONF-940277–, pp. 59-64) **A short-wave radiometer array across the tropical Pacific Ocean as a component of the TOGA-TAO buoy array.** Reynolds, R.M. (Brookhaven National Lab., Upton, NY (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The purpose of this document is to bring together pertinent information concerning the NOAA TOGA-TAO buoy array so that a decision can be made for the following questions: (1) Are the scientific gains from an array of short-wave radiation sensors in the equatorial Pacific Ocean sufficiently impelling that DOE/ARM should provide financial and material support to NOAA/PMEL to install and operate this array? (2) What scientists and/or scientific studies would directly benefit from such a data set? (3) What should that array look like? That is, what sub-set of buoys should be so implemented given the per-buoy cost of the implementation?

24621 (CONF-940277–, pp. 81-84) **The role of water vapor, clouds, and the large-scale circulation in regulating sea surface temperatures in the tropical Pacific.** Arking, A. (Johns Hopkins Univ., Baltimore, MD (United States)). USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The western tropical Pacific is characterized by unusually warm sea surface temperatures - the so-called "warm pool" - with an asymmetric temperature distribution. The role of clouds and water vapor in determining the region's unique character has been the subject of a number of recent papers. They have fueled a debate on what maintains the warm pool, on the relative role of radiation and dynamics in determining sea surface temperatures, and on possible feedback mechanisms involving clouds and water vapor. A statistical analysis of four years of observations over the tropical Pacific has provided some insight and suggests an explanation based on a greenhouse instability that is quenched when high-level clouds develop in response to increasing sea surface temperatures. The data used in this study include earth radiation budget parameters from the Earth Radiation Budget Experiment (ERBE), cloud parameters from the International Satellite Cloud Climatology Project (ISCCP), total column water vapor from the National Oceanic and Atmospheric Administration's (NOAA) TIROS operational vertical sounder (TOVS), and sea surface temperatures from NOAA based on a blend of AVHRR (advanced very high resolution radiometer) and in situ measurements. The data consist of monthly averages on a 2.5° latitude by 2.5° longitude grid, extending from 150E to 180E and 25S to 25N, for the period February 1985 through January 1989.

24622 (CONF-940277–, pp. 115-118) **Observations from the central equatorial Pacific Experiment and their significance to siting and modeling objectives of the Atmospheric Radiation Measurement Program.** Corral, J. del (Univ. of California, San Diego, La Jolla, CA (United States)); Boer, E.; Collins, W.; Conant, W.; Lubin, D.; McFarquhar, G.; Ramanathan, V.; Sherwood, S.; Grassl, H.; Heymsfield, A. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

The Central Equatorial Pacific Experiment (CEPEX) was motivated by the fact that sea surface temperatures (SST) in the world's oceans exhibit significant spatial gradients except for those regions where the SST exceed 27 (degrees)C (or 300K). In such warm oceans, the gradients diminish such that the maximum SST is within a few degrees of 27 (degrees)C. The tropical western Pacific is an important example of this outstanding and, as yet, unexplained phenomenon and is referred to as the western Pacific warm pool. Recent work suggests that the link between the warm ocean, deep convection, cirrus formation, and reduction of sea surface solar heating regulate maximum SSTs like a thermostat. CEPEX was conducted from March 5 to April 7, 1993 and utilized buoy measurements, aircraft measurements, vaisala sonde, dropsonde, and FTIR spectrography. One of the most powerful analysis tools to come out of CEPEX is the CEPEX Integrated Data System (CIDS). This system is an ongoing effort to provide scientists with a self-contained software and data system that will allow them to collocate any measurement taken during CEPEX, analyzed fields, and model results. CIDS will also provide a gridded synoptic scale estimate of the atmospheric column heat budget terms, binned by SST and convective activity. These estimates will be derived from all the available CEPEX measurements. This information will give GCM modelers more understanding of the tropical Pacific.

24623 (CONF-940277–, pp. 217-221) **The effects of radiative transfer in maintaining the Indian summer monsoon.** Leach, M.J. (North Carolina State Univ., Raleigh, NC (United States)); Raman, S. USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div. Apr 1995. From Atmospheric radiation measurement science team meeting; Charleston, SC (United States); 28 Feb - 3 mar 1994. In *Proceedings of the Fourth Atmospheric Radiation Measurement (ARM) Science Team Meeting.* 373p. Order Number DE95009951. Source: OSTI; NTIS; GPO Dep.

Atmospheric radiative transfer is an important thermodynamic forcing for the Indian summer monsoon. The monsoon is a component of a larger scale circulation system the principal components of which are the Hadley cell and the Walker Circulation. The Hadley cell is a thermally direct circulation that transports heat toward the poles. In the northern hemispheric summer, the ascending branch of the Hadley cell moves northward, due to heating of the land masses. This ascending branch of the Hadley cell is referred to as the Intertropical Convergence Zone (ITCZ). The return

branch of the Hadley cell is characterized by southwesterly surface winds. At the surface, the ITCZ is marked by convergence of southwesterly surface winds from the south and northeasterly surface winds from the north. As the ITCZ moves northward, the southern extent of the northerly surface winds also moves northward, and southerly surface winds from the south side of the ITCZ also move northward. The surface convergence at the ITCZ is a driving mechanism for the summer monsoon circulation. The northward drift of the Hadley cell in the northern summer ITCZ is the deep convection over the warm pool of water in the western tropical Pacific ocean, located at about 160E. The latent heating in the deep convection drives another direct circulation, known as the Walker Circulation. The upper branch of the Walker Circulation over south Asia is easterly winds created by the deep convection in the western tropical Pacific. Convective activity over the Indian peninsula interacts with the Walker Circulation, creating a jet structure over the western part of India and the eastern Arabian Sea. This structure is known as the Tropical Easterly Jet (TEJ). Secondary circulations associated with the Indian convection also help to maintain the baroclinicity, which is essential to the development of monsoon depression, the maintenance of the monsoon trough, and the circulation and hydrology of the region in general.

24624 (CONF-9406323–2) **Toxicity testing strategies for assessing water-quality conditions in receiving streams.** Stewart, A.J. Oak Ridge National Lab., TN (United States). [1994]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 3. annual workshop on industrial ecology; Wood Hole, MA (United States); 25-26 Jun 1994. Order Number DE95012300. Source: OSTI; NTIS; GPO Dep.

This paper explores the use of short-term, EPA-approved laboratory toxicity tests for assessing water-quality conditions in streams and rivers. Strategies for the cost-effective application of such tests for long-term monitoring objectives are considered in the context of logistic constraints and statistical design. A subtle but important difference in objectives for effluent versus ambient testing is this: in effluent testing for regulatory purposes, a key objective is to determine how toxic an effluent is; in ambient testing, the main objective usually is that of determining if the water at a site is toxic. This difference shapes the strategy for cost-effective ambient testing and determines the framework for effective statistical analysis and interpretation of ambient toxicity test results. Recommendations derived as " lessons learned" from large-scale ambient toxicity testing programs for receiving streams at Department of Energy (DOE) facilities include: (1) testing more frequently with one species (preferably Ceriodaphnia) generally is more effective, in terms of information gained per dollar spent, than testing less frequently with two or more species; (2) use five or more sites per test period, plus two or more reference sites, whenever possible; (3) use four to six test periods per year; and (4) use diagnostic testing to supplement the ambient-testing program. Various laboratory and in situ methods for environmental assessment are now under development, but these methods probably will not gain acceptance for use in regulatory situations for many years. Rapid growth in need for ecological risk assessments outstrips the rate at which new test procedures are approved for regulatory purposes. Thus, laboratory tests for estimating possible environmental impacts of toxic or disruptive pollutants are likely to be used more frequently, not less frequently, during the next decade.

24625 (CRIE-U–94017) **Development of technologies to hasten the growth of Japanese flounder. 4. Effects of temperature on the growth of Japanese flounder.** Iwata, N. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Kikuchi, K.; Furuta, T.; Honda, H.; Kiyono, M. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Aug 1994. 35p. (In Japanese). Order Number DE95790561. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

Effects of temperature were examined on the growth of flounder from the juvenile to the immature in a flounder culture system in order to promote regional fisheries. Rearing experiments were carried out on the juvenile, young 1, young 2 and immature of the flounder at constant water temperatures at 10, 15, 25, and 30°C for 20 days. Feeds sold in the market were given twice a day to a satiation level. The ratio of increase in body weight per day rose with the rise in water temperature in every developmental stage, reaching the maximum at 20 or 25°C and declining at 30°C. The feeding rates per day for the body weight indicated the similar tendency. The ratio of increase in body weight over feeding rates slightly declined at 25°C as compared at 20°C. The ratio of increase in body weight per day remarkably declined in the young 2 and the immature at a high temperature of 30°C. It was revealed that the optimum temperature for the growth of flounder during the developmental stage from the juvenile to the immature exists between 20 and 25°C. It was also revealed that, for flounder after the developmental stage of the young 2, the growth rate declined remarkably as the water temperature rose close to a high temperature of 30°C. 32 refs., 20 figs., 6 tabs.

24626 (DOE/BP/21708–3) **Identification of the spawning, rearing, and migratory requirements of fall chinook salmon in the Columbia River Basin. Annual report 1993.** Rondorf, D.W.; Tiffan, K.F. National Biological Survey, Cook, WA (United States). Columbia River Research Lab. Dec 1994. 157p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-91BP21708. Order Number DE95014440. Source: OSTI; NTIS; GPO Dep.

Recovery efforts for the endangered fall chinook salmon necessitates knowledge of the factors limiting the various life history stages. This study attempts to identify those physical and biological fctors which affect spawning of the fish in the free-flowing Snake River and their rearing seward migration through Columbia River basin reservoirs. The spawning was generally a November event in 1993, with some activity in late Oct. and early Dec. Spawning habitat availability was assessed by applying hydraulic and habitat models to known fall chinook salmon spawning sites. Juveniles were seined and PIT tagged in the free-flowing Snake River, and in the Columbia River in he Hanford Reach and in McNary Reservoir. Subyearling fish were marked at McNary Dam to relate river flow and migration patterns of juveniles to adult returns. Hydroacoustic surveys were conducted on McNary and John Day reservoirs and in net pens.

24627 (DOE/BP/92818–4) **Migratory behavior of adult spring chinook salmon in the Willamette River and its tributaries.** Schreck, C.B.; Snelling, J.C.; Ewing, R.E.; Bradford, C.S.; Davis, L.E.; Slater, C.H. Oregon State Univ., Corvallis, OR (United States). Dept. of Fisheries and Wildlife. Jan 1994. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-88BP92818. Order Number DE95014442. Source: OSTI; NTIS; GPO Dep.

Migration patterns of adult spring chinook salmon above Willamette Falls differed depending on when the fish passed the Falls, with considerable among-fish variability. Early-run fish often terminated their migration for extended periods of time, in association with increased flows and decreased temperatures. Mid-run fish tended to migrate steadily upstream at a rate of 30-40 km/day. Late-run fish frequently ceased migrating or fell back downstream after migrating 10-200 km up the Willamette River or its tributaries; this appeared to be associated with warming water during summer and resulted in considerable mortality. Up to 40% of the adult salmon entering the Willamette River System above Willamette Falls (i.e. counted at the ladder) may die before reaching upriver spawning areas. Up to 10% of the fish passing up over Willamette Falls may fall-back below the Falls; some migrate to the Columbia River or lower Willamette River tributaries. If rearing conditions at hatcheries affect timing of adult returns because of different juvenile development rates and improper timing of smolt releases, then differential mortality in the freshwater segment of the adult migrations may confound interpretation of studies evaluating rearing practices.

24628 (DOE/ER/60376–T4) **Shelf export of particulates/transport in continental margin waters. Final report.** Pietrafesa, L.J. North Carolina State Univ., Raleigh, NC (United States). Dept. of Marine, Earth and Atmospheric Sciences. [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-85ER60376. Order Number DE95014741. Source: OSTI; NTIS; GPO Dep.

During the present funding period, research activities at NCSU have been directed towards: publishing the results of SEEP-I; publishing further results from NCSU's South Atlantic Bight studies; designing and constructing four cages which house the 3 NCSU and 1 BNL RD-Acoustic Doppler Current Profilers used successfully in SEEP-II, calibrating all current meters, transmissometers, thermister chains and conductivity pressure and temperature sensors for SEEP-II phases 2 and 3; determining the temporal and spatial scales of physical processes observed during phase 1 of SEEP-II in preparation for finalizing the mooring positions and sampling intervals for SEEP-II; shipping all NCSU gear to the URI and ODU; and successful deployment of NCSU SEEP-II, phases 1 and 2 moorings.

24629 (ENEA-RT-AMB–93-11) **Membrane technologies for environmental applications.** Fabiani, C. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute). ENEA, Casaccia (Italy). Area Energia Ambiente e Salute. Oct 1993. 67p. Order Number DE95789709. Source: OSTI; NTIS (US Sales Only).

Research and development programs to improve the environmental acceptance of industrial processes are presently centered on the demonstration of new cleaner technologies. Separation unit operations based on the use of new ion exchangers, active carbons and selective membranes will play a priority role in the frame of the above strategy. A series a case histories of relevant environmental concern as the treatment of ground water polluted by nutrients, green waters, milk whey, industrial waters of the textile and metallurgical sectors are discussed. The research and development needs for new membranes suitable for the treatment of gas mixtures and gaseous emissions, are also briefly outlined.

24630 (ENEA-RT-AMB–94-01) **Hydrological studies in Orbetello lagoon.** Gorelli, V. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute). ENEA, Casaccia (Italy). Area Energia Ambiente e Salute. May 1994. 37p. (In Italian). Order Number DE95789707. Source: OSTI; NTIS (US Sales Only).

In the Orbetello (Italy) lagoon, to estimate the amount and velocity of the sea-lagoon water exchange, ENEA (Italian Agency for New Technologies, Energy and the Environment) carried out 129 flow tests (39 in Nassa, 48 in Ansedonia and 42 in Fibbia canal), in september 1988. For each test section, regression lines flow versus difference of level between water level at current time and the level occurring when no flow arises (i.e. when flow changes from ingoing to outgoing) were carried out: under certain hypotesis (not far from the real behaviour), in fact, tide flow through any section of the canal is directly proportional to the difference of level defined before. Uncertainty in determination of flow inversion local level may generate some errors. To minimize them, data were grouped, putting in the same group those occurring in the same half-wave tide. Groups composed by only one, or two data were neglected, because linear regression analysis is impossible in the first case and not significant (since correlation is always equal to one) in the last one. In april 1993, Nassa and Ansedonia mouths were closed; pumping stations started, forcing water, through those mouths, into the lagoon from the sea: in june, steady-state was reached, with constant outgoing flow by Fibbia mouth added up to tide alternate (sine-wave) flow. This behaviour was confirmed by regression analysis of some flow tests, made in the forced flow state described before.

24631 (ENEA-RT-AMB–94-03) **Meteorological and hydrological measurements in gulf of La Spezia (Italy).** Bassano, E. (ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute); Boniforti, R.; Iacovelli, M.; Marri, P.; Pezzani, A. ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute. May 1994. 33p. (In Italian). Order Number DE95789708. Source: OSTI; NTIS (US Sales Only).

The acquisition of meteorological and hydrological data inside the gulf of La Spezia was carried on during a research program which aim was to examine the environmental conditions of the coastal water. One of the proposed aim was to acquire data about the stratification of the water column and the effects of the wind stress. In this report it is briefly described the used instruments and examine, in a qualitative way, temporal sequences of measurements of wind and temperature of air and water acquired during 1991. Data obtained during 1990 and 1992, which are available on magnetic support, will be successively described. One of the important achieved results is the average daily cycle of air and water temperature for each month.

24632 (ENEA-RT-AMB–94-04) **Water properties measurements near Sturla (Genoa, Italy) depurator.** Bassano, E. (ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute); Boniforti, R.; Iacovelli, M.; Marri, P.; Pezzani, A. ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute. May 1994. 46p. (In Italian). Order Number DE95789713. Source: OSTI; NTIS (US Sales Only).

In a study on the dispersion mechanisms of outflowing from underwater pipes conducted by ENEA (Italian Agency for New Technologies, Energy and the Environment) on behalf of the regional authority for Liguria, a monitoring system was positioned in the area in front of the depurator at Sturla (Genoa, Italy). This system, which is briefly described in the text, was on-line during 1993. The large data set, which was acquired, are useful to examine the hydrological properties and the processes of mixing and stratification of the water column which influence the dispersion of pollutants in the area. The measurements included air and water temperature, precipitation, salinity, sigma TAU, wind velocity, pH and oxygen. Data are summarized in graphs of vertical profiles and annual time series of daily averaged values.

24633 (ENEA-RT-AMB–94-06) **Temperature measurements of surface waters in La Spezia gulf.** Ferretti, E. (ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute); Lisca, A.; Marri, P.; Raso, G. ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute. Aug 1994. 41p. (In Italian). Order Number DE95789712. Source: OSTI; NTIS (US Sales Only).

This report describes the instruments used to measure in continuum the temperature of the surface water layer in the gulf of La Spezia. Furthermore, the results collected in situ during two campaigns are presented and discussed. The first campaign was carried out on 22 November 1991 to evaluate the thermal plume due to the outfall of the electrical power station working at the maximum power level. The second campaign was carried out on 19 December 1991, a week after the station was not operative and the thermal effect observed earlier was not present. Simultaneously with the in situ measurements during the first campaign, an airplane using infrared (IR) radiometer mapped the spatial distribution of the sea surface temperature in the gulf. The in situ measurements were used to calibrate the remotely sensed data.

24634 (ENEA-RT-AMB–94-16) **Effects of industrial activities on physical and chemical characteristics of water of La Spezia Harbour (Italy).** Baldi, A. (ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute); Bassano, E.; Jacovelli, M.; Marri, P.; Pezzani, A.; Schirone, A. ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute. Jul 1994. 28p. (In Italian). Order Number DE95789740. Source: OSTI; NTIS (US Sales Only).

In cooperation with local authorities and ENEL (National Electricity Board of Italy), ENEA (National Agency for New Technologies, Energy and the Environment) is conducting a study aimed at investigating the effects of industrial activities on the physico-chemical characteristics of the water of La Spezia harbour. In this frame a monitoring system is deployed since 1989 for continuous recording of hydrological and meteorological parameters relevant to a description of the environmental quality of the marine area under investigation. In particular, this report describes the influence of the thermal discharge from the ENEL electric power station on the harbour water temperature in the period from 15 september 1992 to 15 november 1992. It also describes the effects of natural phenomena, such as the inflowing of water from the Magra river, on the reference temperature in La Spezia harbour. Data obtained by the monitoring system are summarized in graphical form as far as air temperature, water temperature, salinity and precipitation are concerned.

24635 (ENEA-RT-AMB–94-18) **Remote sensing techniques applied to archaeological research.** Vitiello, F. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Talice, S. ENEA, Casaccia (Italy). Area Energia Ambiente e Salute. Oct 1994. 14p. (In Italian). (CONF-9404274–1: Forma lacus antiqui conference on geoarchaeology, Bolsena (Italy), 30 Apr 1994). Order Number DE95789741. Source: OSTI; NTIS (US Sales Only).

The paper describes the airborne remote sensing techniques and their applications to the archaeological research. Since 1990 ENEA (Italian Agency for New Technologies, Energy and the Environment)-Alenia aircraft has realized some missions to evaluate the possible applications of airborne remote sensing in archaeological research; the paper shows the mission which has carried out in Napoli gulf with CZCS (coastal zone color scanner) multispectral scanner and the processing of digital imagery which allowed the identification of archaeological structures in the sea. Other activities are in progress (for example in the Bolsena Lake and in Nemi Lake) because in Italy there are many known and unknown archaeological structures.

24636 (ETDE-DE–174) **The lower Weser river in 1993.** Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany); Arbeitsgemeinschaft zur Reinhaltung der Weser, Duesseldorf (Germany); Senator fuer Umweltschutz und Stadtentwicklung, Bremen (Germany). Dec 1994. 83p. (In German). Order Number DE95795754. Source: OSTI; NTIS (US Sales Only).

The report starts with a historical outline of the development of the river and its region. The Weser river is a tidal river, and its special characteristics are gone into. The water quality was investigated in a river section 70 km long. Renaturation measures along the lower Weser river and its marshland have been discussed for a long time. The present state of discussion is outlined at the end of the report.

24637 (FZKA–5549) **Enrichment and identification of polar and nonpolar nitrogen compounds with low molecular masses in effluents of municipal sewage clarification plants with secondary treatment.** Grohmann, K. Forschungszentrum Karlsruhe GmbH Technik und Umwelt (Germany). Inst. fuer Technische Chemie; Karlsruhe Univ. (T.H.) (Germany). Fakultaet fuer Chemie. Feb 1995. 149p. (In German). Order Number DE95790241. Source: OSTI; NTIS (US Sales Only).

It is proposed in this report to contribute to elucidating about 99% unknown organic nitrogen compounds present as Dissolved Organic Nitrogen (DON) in a sewage clarification plant. For this, an enriching method based on reversed phases was developed as a first step which, following enrichment by the factor 5000, allows reproducible recovery up to 99% to be achieved, at least for the nitrogen compounds metered in. Considering possible losses due to adsorption on the vessel materials and on sample constituents, the experimental conditions must be very strictly observed. When these methods were applied to untreated and membrane filtered samples, effects were observed which suggest that the compounds investigated are associated with other sample constituents. This called for a new definition of the fractions obtained by membrane filtration. In the second part of the report a screen is elaborated which, after application of the PBM algorithm to the GC/MS spectra obtained in the analysis of true samples, allows an evaluated statement to be made on the organic compound present. Consequently, an at last 30% agreement indicates that a nitrogen containing compound can be supposed. The elaborated enrichment and evaluation methods were applied and ten samples processed with concentration factors of 1000-20.000 which yielded 133 different nitrogen compounds, with an probability of occurence of at least 30% put out. (orig./SR)

24638 (INIS-mf–14542) **Preliminary report in radiological safety for 1993 hydrology campaign.** Badano, A. (Nuclear Technology National Direction, Montevideo (Uruguay)); Suraez, R.; Dellepere, A.; Barreiro, M. Ministerio de Industria, Energia y Mineria, Montevideo (Uruguay). Direccion Nacional de Tecnologia Nuclear. [1993]. 12p. (In Spanish). Order Number DE95632316. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this report is to provide a study about industrial effluents influence on water pollution of Montevideo coastal beaches. The methods which have been considered are nuclear tracer techniques with a special attention in the radioprotection supervision. Three points are considered as evaluation: handling of radioactive tracers and safety, radiation protection workers, environment and public safety. tabs.

24639 (PNL–10627) **Ecological evaluation of proposed dredged material from Richmond Harbor Deepening Project and the Intensive study of the Turning Basin.** Pinza, M.R. (Battelle/Marine Sciences Lab., Sequim, WA (United States)); Mayhew, H.L.; Karle, L.M.; Kohn, N.P.; White, P.J.; Word, J.Q.; Michaels, L.L. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 660p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015196. Source: OSTI; NTIS; GPO Dep.

Richmond Harbor is on the eastern shoreline of central San Francisco Bay and its access channels and several of the shipping berths are no longer wide or deep enough to accommodate modern deeper-draft vessels. The Water Resources Development Act of 1986 (PL99-662) authorized the US Army Corps of Engineers (USACE), San Francisco District to deepen and widen the navigation channels in Richmond Harbor. Several options for disposal of the material from this dredging project are under consideration by USACE: disposal within San Francisco Bay, at open-ocean disposal sites, or at uplands disposal sites. Purpose of this study was to conduct comprehensive evaluations, including chemical, biological, and bioaccumulation testing of sediments in selected areas of Richmond Harbor. This information was required by the Environmental Protection Agency (EPA) and USACE. Battelle/Marine Sciences Laboratory collected 20 core samples, both 4-in. and 12-in., to a project depth of -40 ft mean lower low water (MLLW) (-38 ft MLLW plus 2 ft of overdepth) using a vibratory-hammer core. These 20 field samples were combined to form five test composites plus an older bay mud (OBM) composite that were analyzed for physical/chemical parameters, biological toxicity, and tissue chemistry. Solid-phase tests were conducted with the amphipod, Rhepoxynius abronius; the clam, Macoma nasuta; and the polychaete worm, Nephtys caecoides. Suspended-particulate-phase (SPP) tests were conducted with the sanddab, Citharichthys stigmaeus; the mysid, Holmesimysis costata; and the bivalve, Mytilus galloprovincialis. Bioaccumulation of contaminants was measured in tissues of Macoma nasuta and Nereis virens. Sediments from one ocean reference sediment, and two in-bay reference sediments, were tested concurrently. Results from analysis of the five test treatments were statistically compared with the reference sediment R-OS in the first five sections of this report.

24640 (UCRL-ID–118533) **Pencil beam radar selectivity of ocean wave spectra.** Manasse, R. Lawrence Livermore National Lab., CA (United States). 1 Aug 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015379. Source: OSTI; NTIS; GPO Dep.

Over the past several years some very interesting data relevant to ocean wave backscatter have been produced by non scanning pencil beam radars with high range resolution. These radars are located-on land which overlooks the water/sea surface and operate at low grazing angles (LGA). Prominent among these are the X-band RSRE-Thorn EMI and the LLNL-Hughes real aperture radars employed in the Joint US/UK ocean wave experiments in Loch Linnhe and the Sound of Sleat (Scotland). The range-time image obtained with the RSRE radar is typical of the many images which have been obtained. The most prominent features of these images are linear regions or strips of increased average RCS having temporal durations up to or exceeding 100 seconds. For HH polarization these features are marked by the presence of periodic spikes in RCS. The features appear quite consistent with wave groups which are moving approximately parallel to the radar boresight. A self-consistent model of this wave group behavior, as manifested in the radar images, has been proposed by Tulin. This model provides estimates of the wavelengths involved and accounts for the periodicity of the spiky returns which appear to be due to the passage of nonlinear or incipiently breaking waves through the wave groups. Nothing in this model precludes the presence of multiple wave groups moving at different velocities. In fact, some images exhibit wave groups moving at different velocities, and in some cases both incoming and outgoing wavegroups

are present simultaneously. Obviously, X-band Bragg waves cannot explain these features because the lifetime of these waves is, at best, a few seconds. The association of these features with the scattering from the crests of much larger (e.g., meters) waves is reasonable because the lifetime of these waves is very long. However, it is not reasonable to assume that ambient wavegroups in the field of view of the radar all just happen to be moving along the radar boresight.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

Refer also to citation(s) 24725

5501 Behavioral Biology

Refer also to citation(s) 23461, 23556, 23683, 24709

5502 Biochemistry

Refer also to citation(s) 23421, 23422, 23468, 23499, 24607, 24682, 24688, 24689, 24692, 24693, 24694, 24695, 24739

24641 (CONF-9104300–Absts.) **Workshop in computational molecular biology, April 15, 1991–April 14, 1994.** Tavare. S. University of Southern California, Los Angeles, CA (United States). 12 Apr 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-91ER61165. (CONF-9308268–Absts.: Interface 1991: computing science and statistics; Workshop in statistical issues in molecular biology; Joint American Statistical Association (ASA), Institute of Mathematics Statistics and Biometric Society conference, Seattle, WA (Order Number DE95012915. Source: OSTI; NTIS; GPO Dep.

Funds from this award were used to the Workshop in Computational Molecular Biology, '91 Symposium entitled Interface: Computing Science and Statistics, Seattle, Washington, April 21, 1991; the Workshop in Statistical Issues in Molecular Biology held at Stanford, California, August 8, 1993; and the Session on Population Genetics a part of the 56th Annual Meeting, Institute of Mathematical Statistics, San Francisco, California, August 9, 1993.

24642 (CONF-9406343–Absts.) **Molecular genetics of cancer.** Stillman, B. Cold Spring Harbor Lab., NY (United States). 1994. 336p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-94ER61838. National Cancer Institute, US National Institutes of Health. From 59. Cold Spring Harbor Laboratory symposium on quantitative biology: molecular genetics of cancer; Cold Spring Harbor, NY (United States); 1-8 Jun 1994. Order Number DE95016151. Source: OSTI; NTIS; GPO Dep.

This volume contains abstracts of oral and poster presentations made at the LIX Cold Springs Harbor Symposium on Quantitative Biology held June 1–8, 1994.

24643 (CONF-950587–1) **The effect of biotin on the production of succinic acid by Anaerobiospirillum succiniciproducens.** Nghiem, N.P. (and others); Davison, B.H.; Thompson, J.E. Oak Ridge National Lab., TN (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 17. symposium on biotechnology for fuels and chemicals; Vail, CO (United States); 7-11 May 1995. Order Number DE95013991. Source: OSTI; NTIS; GPO Dep.

Succinic acid is an intermediate of the tricarboxylic acid (TCA) cycle, and therefore, is found in almost all plant and animal cells, albeit at very low concentrations. It has a very wide usage range, which includes applications in agriculture, food, medicine, plastics, cosmetics, textiles, plating and waste-gas scrubbing. Succinic acid currently is produced commercially by chemical processes. A fermentation process for its production is of great interest because in such process, renewable resources such as corn-derived glucose can be used as starting material. There is not a current biological process for the commercial production of succinic acid. Extensive efforts have been devoted to the isolation and screening of succinic acid-producing microorganisms. The anaerobic bacterium, Anaerobiospirillum succiniciproducens, is considered among the best direct succinic acid producers. A number of patents concerning the production of succinic acid by this organism have been issued. Our first attempt to develop a biological process for the production of succinic acid by A. succiniciproducens involved fermentation media improvement, in particular the use of supplemented nutrients. In this note, we show that higher yield of succinic acid could be achieved by supplementing the fermentation media with biotin, as a potential nutrient supplement representative.

24644 (DOE/ER/13970–T2) **[CarbBank and the complex carbohydrate structure database. Annual report 1994].** Albersheim, P.; Doubet, S. Georgia Univ., Athens, GA (United States). Complex Carbohydrate Research Center. 21 Apr 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-88ER13970. Order Number DE95012192. Source: OSTI; NTIS; GPO Dep.

A brief status report and forthcoming changes to the CarbBank, a carbohydrate database, is provided.

24645 (DOE/ER/13970–T3) **[Carbank and the complex carbohydrate structure database].** Georgia Univ., Athens, GA (United States). Research Foundation. 3 Jun 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-88ER13970. Order Number DE95012191. Source: OSTI; NTIS; INIS; GPO Dep.

A brief overview of the CarbBank, a carbohydrate database, is provided.

24646 (DOE/ER/14071–4) **Molecular biology of Lea genes of higher plants. Progress report.** Dure, L.S. III. Georgia Univ., Athens, GA (United States). Research Foundation. 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-89ER14071. Order Number DE95014343. Source: OSTI; NTIS; GPO Dep.

Annual progress report discusses achievements on the elucidation of the function of the D-7 Lea proteins. Studies aimed at the immunoassay, fractionation, and molecular modeling are described.

24647 (DOE/ER/20034–2) **Regulation of polyamine synthesis in plants. Annual progress report, July 1, 1992–June 30, 1993.** Malmberg, R.L. Georgia Univ., Athens, GA (United States). Dept. of Botany. [1995]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-91ER20034. Order Number DE95015430. Source: OSTI; NTIS; GPO Dep.

After isolation of a cDNA clone for the plant ARGdc, this research focused on unusual post-translational modifications occuring in a arginine decarboxylase cDNA clone in oats. A novel regulatory mechanism for polyamines was explored and an attempt was made to characterize it. A plant ornithine decarboxylase cDNA was identified in Arabidopsis. Further work remains on the mechanisms of polyamine regulation and function in plants.

24648 (DOE/ER/20034–3) **Regulation of polyamine synthesis in plants. Final progress report, July 1, 1991–December 31, 1994.** Malmberg, R.L. Georgia Univ., Athens, GA (United States). Dept. of Botany. [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-91ER20034. Order Number DE95015429. Source: OSTI; NTIS; GPO Dep.

This research focused on unusual post-translational modifications occuring in a arginine decarboxylase cDNA clone in oats. A novel regulatory mechanism for polyamines was explored and an attempt was made to characterize it. A plant ornithine decarboxylase cDNA was identified in Arabidopsis. Further work remains on the mechanisms of polyamine regulation and function in plants.

24649 (DOE/ER/25212–T1) **Workshop on algorithms for macromolecular modeling. Final project report, June 1, 1994–May 31, 1995.** Leimkuhler, B.; Hermans, J.; Skeel, R.D. Kansas Univ., Lawrence, KS (United States). [1995]. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-94ER25212. Order Number DE95015463. Source: OSTI; NTIS; GPO Dep.

A workshop was held on algorithms and parallel implementations for macromolecular dynamics, protein folding, and structural refinement. This document contains abstracts and brief reports from that workshop.

24650 (DOE/ER/61040–3) **Characterization of the mammalian DNA polymerase gene(s) and enzyme(s). Annual progress report.** Mishra, N.C. South Carolina Univ., Columbia, SC (United States). Dept. of Biological Sciences. Jan 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-90ER61040. Order Number DE95016134. Source: OSTI; NTIS; GPO Dep.

Consistent with the long term goal of our research to understand the nature of the key enzymes in eukaryotic DNA replication we have characterized the properties of the wild type DNA polymerases of the α-family and their mutants. We have also provided evidence for the role of aphidicolin in the elongation process of the in vivo DNA replication in eukaryotic cells. We also developed a technology for planned prep from a large numbers of clones for direct screening by size or restriction digestion in order to facilitate our goals to clone the DNA polymerase gene.

24651 (DOE/ER/61040–4) **Characterization of the mammalian DNA polymerase gene(s) and enzyme(s). Annual progress report.** Mishra, N.C. South Carolina Univ., Columbia, SC (United States). Jan 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-90ER61040. Order Number DE95016135. Source: OSTI; NTIS; GPO Dep.

Two Genes for DNA polymerase delta were identified from the wild type Chinese hamster ovary cells. These genes were cloned via RT-PCR from mRNA prepared the Chinese hamster ovary cells using primers specific to conserved sequences of the DNA polymerase δ gene. The first gene encodes a PCNA dependent DNA polymerase δ gene whereas the second gene encodes a PCNA independent DNA polymerase δ gene. Methods were developed to clone these genes in expression vector and host systems. The role of the two genes in DNA replication and repair was determined.

24652 (DOE/ER/61040–T1) **Characterization of the mammalian DNA polymerase gene and protein. Annual progress report.** Mishra, N.C. South Carolina Univ., Columbia, SC (United States). Jan 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-90ER61040. Order Number DE95016136. Source: OSTI; NTIS; GPO Dep.

Methods were developed to purify the DNA polymerases of the α-family from Chinese hamster cells and their mutants selected as resistant to aphidicolin or specific inhibitor of DNA polymerases of the α-family. The wild type and mutant DNA polymerases were characterized with respect to their biochemical properties. A methodology was also developed to identify the replication intermediates and aphidicolin was found to inhibit a replication intermediate of the 24Kb size indicating the fact that aphidicolin inhibits the elongation process during DNA replication. This is the first demonstration of such role of aphidicolin in the eukaryotic DNA replication.

24653 (ETDE-DE–154) **Analysis of bioengineering research and development structures and potentials in Baden-Wuerttemberg. Final report.** Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg. Arbeitsberichte, v. 40. Jaeckel, G. (Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany)); Huesing, B.; Strauss, E.; Reiss, T. Akademie fuer Technikfolgenabschaetzung in Baden-Wuerttemberg, Stuttgart (Germany); Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany). Dec 1994. 107p. (In German). Order Number DE95790379. Source: OSTI; NTIS (US Sales Only).

The future trends in research activities of the industry, universities and other research institutions in Baden-Wuerttemberg are established on the basis of a written inquiry. Enterprises in biotechnology were also asked about their structure, staff, cooperation projects, and infrastructure. The findings are discussed in interviews with selected biotechnology enterprises. (orig.)

24654 (LA–12893-C, pp. 1-11) **Isotope labeling for NMR studies of macromolecular structure and interactions.** Wright, P.E. (Scripps Research Institute, La Jolla, CA (United States)). Los Alamos National Lab., NM (United States). Dec 1994. Grant GM36643; Grant CA27498. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Implementation of biosynthetic methods for uniform or specific isotope labeling of proteins, coupled with the recent development of powerful heteronuclear multidimensional NMR methods, has led to a dramatic increase in the size and complexity of macromolecular systems that are now amenable to NMR structural analysis. In recent years, a new technology has emerged that combines uniform ^{13}C, ^{15}N labeling with heteronuclear multidimensional NMR methods to allow NMR structural studies of systems approaching 25 to 30 kDa in molecular weight. In addition, with the introduction of specific ^{13}C and ^{15}N labels into ligands, meaningful NMR studies of complexes of even higher molecular weight have become feasible. These advances usher in a new era in which the earlier, rather stringent molecular weight limitations have been greatly surpassed and NMR can begin to address many central biological problems that involve macromolecular structure, dynamics, and interactions.

24655 (LA–12893-C, pp. 15-26) **Oxygen chemistry in biology: Vibrational spectroscopy, stable isotopes, and future applications.** Babcock, G.T. (Michigan State Univ., East Lansing, MI (United States)). Los Alamos National Lab., NM (United States). Dec 1994. Grant NIH GM25480. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Dioxygen is an ideally suited substrate for enzymatic manipulation in oxidation-reduction chemistry and in substrate transformation. It is a powerful oxidant with a midpoint potential of 0.815 at neutral pH; at the same time, however, it exists in a triplet state in its most stable electronic configuration. This latter property confers kinetic inertness as a result of spin-conservation restrictions on reaction chemistry. If these restrictions can be overcome and controlled, dioxygen's high redox potential can be used to maximize efficiency in free-energy conversion processes and to effect activation of relatively inert substrates.

24656 (LA–12893-C, pp. 27-42) **Use of specifically ^{15}N-labeled histidine to study structures and mechanisms within the active sites of serine proteinases.** Bachovchin, W.W. (Tufts Univ. School of Medicine, Boston, MA (United States)). Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

The current emphasis in biological NMR work is on determining structures of biological macromolecules in solution. This emphasis is appropriate because NMR is the only technique capable of providing high-resolution structures that are comparable to those of x-ray crystallography for molecules in solution. This structural knowledge is immensely valuable and is needed in many areas of investigation. However, as valuable as such structural knowledge is, it never provides all the answers; a structure often reveals more questions than answers.

24657 (LA–12893-C, pp. 59-71) **High-resolution polypeptide structure and dynamics in anisotropic environments: The gramicidin channel.** Cross, T.A. (Florida State Univ., Tallahassee, FL (United States)); Lee, K.C.; Ketchem, R.R.; Hu, W.; Lazo, N.D.; Huo, S. Los Alamos National Lab., NM (United States). Dec 1994. Grant AI-23007. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in*

biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs. 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

To understand the details of macromolecular function, high-resolution structural and dynamic detail is essential. The polypeptide fold of the gramicidin channel has been effectively modeled for the past 20 years, yet the functional changes in conductance and channel lifetime associated with amino acid substitutions cannot be predicted. To accomplish this goal, high-resolution electrostatic modeling and the precise orientation of all dipoles are required. Furthermore, an enhanced knowledge of the complex molecular environment of this membrane-bound peptide is needed. An aqueous environment is relatively uniform and achiral. The membrane environment is very heterogenous and chiral. A knowledge of the interactions, specific and nonspecific, between peptide and lipid will aid in developing a better understanding of this environment. To accomplish this goal, it is necessary to study the peptide in an extended lipid bilayer, rather than in a vesicular or micellar form. These latter environments are likely to possess increased dynamics, increased water penetration, and distorted interactions between the polypeptide and membrane surface. To perform NMR studies on bilayer bound peptides, solid state NMR methods are required, and for specific site information, isotopic labels are incorporated using solid phase peptide synthesis.

24658 (LA–12893-C, pp. 73-86) **Isotopic chirality.** Floss, H.G. (Univ. of Washington, Seattle, WA (United States)). Los Alamos National Lab., NM (United States). Dec 1994. Grant GM20264; Grant AI32333. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

This paper deals with compounds that are chiral-at least in part, due to isotope substitution-and their use in tracing the steric course of enzyme reaction in vitro and in vivo. There are other applications of isotopically chiral compounds (for example, in analyzing the steric course of nonenzymatic reactions and in probing the conformation of biomolecules) that are important but they will not be discussed in this context.

24659 (LA–12893-C, pp. 87-103) **Structures of larger proteins in solution: Three- and four-dimensional heteronuclear NMR spectroscopy.** Gronenborn, A.M. (National Institutes of Health, Bethesda, MD (United States)); Clore, G.M. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Complete understanding of a protein's function and mechanism of action can only be achieved with a knowledge of its three-dimensional structure at atomic resolution. At present, there are two methods available for determining such structures. The first method, which has been established for many years, is x-ray diffraction of protein single crystals. The second method has blossomed only in the last 5 years and is based on the application of nuclear magnetic resonance (NMR) spectroscopy to proteins in solution. This review paper describes three- and four-dimensional NMR methods applied to protein structure determination and was adapted from Clore and Gronenborn. The review focuses on the underlying principals and practice of multidimensional NMR and the structural information obtained.

24660 (LA–12893-C, pp. 157-169) **Selective ^{2}H and ^{13}C labeling in NMR analysis of solution protein structure and dynamics.** LeMaster, D.M. (Northwestern Univ., Evanston, IL (United States)). Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Preparation of samples bearing combined isotope enrichment patterns has played a central role in the recent advances in NMR analysis of proteins in solution. In particular, uniform ^{13}C, ^{15}N enrichment has made it possible to apply heteronuclear multidimensional correlation experiments for the mainchain assignments of proteins larger than 30 KDa. In contrast, selective labeling approaches can offer advantages in terms of the directedness of the information provided, such as chirality and residue type assignments, as well as through enhancements in resolution and sensitivity that result from editing the spectral complexity, the relaxation pathways and the scalar coupling networks. In addition, the combination of selective ^{13}C and ^{2}H enrichment can greatly facilitate the determination of heteronuclear relaxation behavior.

24661 (LA–12893-C, pp. 171-188) **Magnetic resonance studies of isotopically labeled paramagnetic proteins: (2FE-2S) ferredoxins.** Cheng, H. (Univ. of Wisconsin, Madison, WI (United States)); Xia, B.; Chae, Y.K.; Westler, W.M.; Markley, J.L. Los Alamos National Lab., NM (United States). Dec 1994. Grant CSRS 92-37206-7699; Grant RR023021; Grant PR02781. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Recent developments in NMR spectroscopy, especially multidimensional, multinuclear NMR techniques, have made NMR the most versatile tool available for studying protein structure and function in solution. Unlike diamagnetic proteins, paramagnetic proteins contain centers with unpaired electrons. These unpaired electrons interact with magnetic nuclei either through chemical bonds by a contact mechanism or through space by a pseudocontact mechanism. Such interactions make the acquisition and analysis of NMR spectra of paramagnetic proteins more challenging than those of diamagnetic proteins. Some NMR signals from paramagnetic proteins are shifted outside the chemical shift region characteristic of diamagnetic proteins; these "hyperfine-shifted" resonances originate from nuclei that interact with unpaired electrons from the paramagnetic center. The large chemical shift dispersion in spectra of paramagnetic proteins makes it difficult to excite the entire spectral window and leads to distortions in the baseline. Interactions with paramagnetic centers shorten T_1 and T_2 relaxation times of nuclei; the consequences are line broadening and lower spectral sensitivity. Scalar (through bond) and dipolar (through space) interactions between pairs of nuclei are what give rise to crosspeak signals in multi-dimensional NMR spectra of small diamagnetic proteins. When such interactions involve a nucleus that is strongly relaxed by interaction with a paramagnetic center, specialized methods may be needed for its detection or it may be completely undetectable by present nD NMR methods.

24662 (LA–12893-C, pp. 197-207) **REDOR NMR of stable-isotope-labeled protein binding sites.** Schaefer, J. (Washington Univ., St. Louis, MO (United States)). Los Alamos National Lab., NM (United States). Dec 1994. Grant NIH 40634. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Rotational-echo, double resonance (REDOR) NMR, a new analytical spectroscopic technique for solids spinning at the magic angle, has been developed over the last 5 years. REDOR provides a direct measure of heteronuclear dipolar coupling between isolated pairs of labeled nuclei. In a solid with a ^{13}C-^{15}N labeled pair, for example, the ^{13}C rotational echoes that form each rotor period following a ^{1}H-^{13}C cross-polarization transfer can be prevented

from reaching full intensity by insertion of a ^{15}N π pulse each half rotor period. The REDOR difference (the difference between a ^{13}C NMR spectrum obtained under these conditions and one obtained with no ^{15}N π pulses) has a strong dependence on the ^{13}C-^{15}N dipolar coupling, and hence, the ^{13}C-^{15}N internuclear distance. REDOR is described as double-resonance even though three radio frequencies (typically ^{1}H, ^{13}C, and ^{15}N) are used because the protons are removed from the important evolution part of the experiment by resonant decoupling. The dephasing of magnetization in REDOR arises from a local dipolar ^{13}C-^{15}N field gradient and involves no polarization transfer. REDOR has no dependence on ^{13}C or ^{15}N chemical-shift tensors and does not require resolution of a ^{13}C-^{15}N coupling in the chemical-shift dimension.

24663 (LA–12893-C, pp. 209-245) **Stable-isotope-labeled carbohydrates and nucleosides: Synthesis and applications in chemistry and biology.** Serianni, A.S. (Univ. of Notre Dame, IN (United States)). Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Carbohydrates play important roles in many key biochemical processes in living cells. For example, they are metabolized to produce energy, mediate cell-cell recognition, and play an indirect role (as constituents of DNA and RNA) in DNA replication, RNA transcription, and protein synthesis. These roles, and others of comparable biochemical significance, have been studied to varying extends with the use of stable isotopically labeled molecules, usually in conjunction with NMR spectroscopy and/or mass spectrometry. For example, carbohydrate metabolism has been monitored in vitro and in vivo with the use of isotopically labeled compounds. Molecular aspects of cell-cell recognition, mediated by cell-surface glycoproteins and glycolipids, have been probed through NMR studies of isotopically labeled oligosaccharides. More recently, the solution behavior of DNA and RNA has been examined through the use of labeled oligonucleotides. In all of these pursuits, the effort and expense to prepare labeled molecules, both of which can be substantial, are more than offset by the wealth of information derived from these studies. This information often cannot be accessed, or can be accessed only with great difficulty, using natural (unlabeled) compounds.

24664 (LA–12893-C, pp. 263-279) **Neutron scattering with deuterium labeling reveals the nature of complexes formed by Ca^{2+}-binding proteins and their regulatory targets.** Trewhella, J. (Los Alamos National Laboratory, NM (United States)). Los Alamos National Lab., NM (United States). Dec 1994. Grant GM40528; Grant DMR-9122444. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Small-angle neutron scattering with deuterium labeling is extremely useful for studying the structures of complex biomolecular assemblies in solution. The different neutron scattering properties of their isotopes of hydrogen combines with the ability to uniformly label biomolecules with deuterium allow one to characterize the structures and relative dispositions of the individual components of an assembly using methods of "contrast variation." We have applied these techniques to studies of the evolutionarily related dumbbell-shaped Ca^{2+}-binding proteins calmodulin and troponin C and their interactions with the target proteins whose activities they regulate. Ca^{2+} is one of the simplest of nature's messengers used in the communication pathways between physiological stimulus and cellular response. The signaling mechanism generally involves Ca^{2+} binding to a protein and inducing a conformational change that transmits a signal to modify the activity of a specific target protein. Ca^{2+} is thus important in the regulation of a diverse array of intracellular responses, including neurotransmitter release, muscle contraction, the degradation of glycogen to glucose to generate energy, microtubule assembly, membrane phosphorylation, etc. It is the conformational language of the Ca^{2+} induced signal transduction that we have sought to understand because of its central importance to biochemical regulation and, hence, to healthy cellular function.

24665 (LA–12893-C, pp. 281-291) **Stereoselective synthesis of stable-isotope-labeled amino acids.** Unkefer, C.J. (Los Alamos National Laboratory, NM (United States)); Martinez, R.A.; Silks, L.A. III; Lodwig, S.N. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

For magnetic resonance and vibrational spectroscopies to reach their full potential, they must be used in combination with sophisticated site-specific stable isotope labeling of biological macromolecules. Labeled amino acids are required for the study of the structure and function of enzymes and proteins. Because there are 20 common amino acids, each with its own distinguishing chemistry, they remain a synthetic challenge. The Oppolzer chiral auxiliary provides a general tool with which to approach the synthesis of labeled amino acids. By using the Oppolzer auxiliary, amino acids can be constructed from several small molecules, which is ideal for stable isotope labeling. In addition to directing the stereochemistry at the α-carbon, the camphorsultam can be used for stereo-specific isotope labeling at prochiral centers in amino acids. By using the camphorsultam auxiliary we have the potential to synthesize virtually any isotopomer of all of the common amino acids.

24666 (LA–12893-C, pp. 293-311) **Time-resolved infrared studies of protein conformational dynamics.** Woodruff, W.H. (Los Alamos National Laboratory, NM (United States)); Causgrove, T.P.; Dyer, R.B.; Callender, R.H. Los Alamos National Lab., NM (United States). Dec 1994. Grant GM35183; Grant GM45807. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

We have demonstrated that TRIR in the amide I region gives structural information regarding protein conformational changes in realtime, both on processes involved in the development of the functional structure (protein folding) and on protein structural changes that accompany the functional dynamics of the native structure. Assignment of many of the amide I peaks to specific amide or sidechain structures will require much additional effort. Specifically, the congestion and complexity of the protein vibrational spectra dictate that isotope studies are an absolute requirement for more than a qualitative notion of the structural interpretation of these measurements. It is clear, however, that enormous potential exists for elucidating structural relaxation dynamics and energetics with a high degree of structural specificity using this approach.

24667 (LA–12893-C, pp. 325-329) **Peptides and proteins.** Bachovchin, W.W.; Unkefer, C.J. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Advances in magnetic resonance and vibrational spectroscopy make it possible to derive detailed structural information about biomolecular structures in solution. These techniques are critically dependent on the availability of labeled compounds. For example, NMR techniques used today to derive peptide and protein structures require uniformity ^{13}C-and ^{15}N-labeled samples that are derived biosynthetically from (U-6-^{13}C) glucose. These experiments

are possible now because, during the 1970s, the National Stable Isotope Resource developed algal methods for producing (U-6-^{13}C) glucose. If NMR techniques are to be used to study larger proteins, we will need sophisticated labelling patterns in amino acids that employ a combination of ^{2}H, ^{13}C, and ^{15}N labeling. The availability of these specifically labeled amino acids requires a renewed investment in new methods for chemical synthesis of labeled amino acids. The development of new magnetic resonance or vibrational techniques to elucidate biomolecular structure will be seriously impeded if we do not see rapid progress in labeling technology. Investment in labeling chemistry is as important as investment in the development of advanced spectroscopic tools.

24668 (LA–12893-C, pp. 331-334) **Carbohydrates/nucleosides/RNA-DNA-ligand interactions.** Kaptein, R.; McConnell, B.; Serianni, A.S.; Silks, L.A. III. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Carbohydrate and nucleotide structural determination using modern spectroscopic techniques is dependent on our ability to label oligonucleotides and oligosaccharides with stable isotopes. Uniform Carbon 13 and Nitrogen 15 labeling of oligonucleotides is important to present-day efforts, which are focused on determining the structure of relatively small oligosaccharides and oligonucleotides, which form the elements of larger structures. Because of the relatively recent interest in three-dimensional structure, the development of techniques used to label them has lagged behind parallel techniques used to label peptides and proteins. Therefore, this group's discussion focused primarily on problems faced today in obtaining oligonucleotides labeled uniformly with carbon 13 and nitrogen 15.

24669 (LA–12893-C, pp. 338) **Conformational study of C8 diazocine turn mimics using $^{3}J_{CH}$ coupling constants with ^{13}C in natural abundance.** Bean, J.W. (SmithKline Beecham Pharmaceuticals, King of Prussia, PA (United States)); Briand, J.; Burgess, J.L.; Callahan, J.F. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

The conformations of two diazocine turn mimics, which were later incorporated into GPIIb/IIIa peptide antagonists, were investigated using nuclear magnetic resonance techniques. The two compounds, methyl (2,5-dioxo-3-(S)-(3-ω-tosylguanidino-propyl)-4-methyl-octahydro-1,4-dazocin-1-yl)a (1) and methyl (2,5-dioxo-3-(S)-(3-ω-tosyl-guanidino-propyl)-octahydro-1,5-diazocin-1-yl)acetate (2), differ only in their substituent at the diazocine position 4 nitrogen, yet this substitution results in a marked difference in the affinity of the resulting analogs for the GPIIb/IIIa receptor. It was of interest to determine if the difference observed in the antagonistic potency between these analogs was related to constitutional or, perhaps, conformational differences. The backbone conformations of these two molecules can be determined by measuring vicinal coupling constants along the trimethylene portion of the C8 ring backbone and by measuring interproton NOE intensities between the diazocine methine proton and the protons of the trimethylene group. For compound 1, $^{3}J_{HH}$ values measured from a P.E.COSY spectrum and interproton distances calculated from ROESY buildup curves indicated the presence of a single C8 ring backbone conformation where the trimethylene bridge adopted a staggered conformation and the Hα1 and Hγ1 protons of the trimethylene group were 2.2 A from the methine proton. For compound 2, however, partial overlap of the central Hβ1 and Hβ2 protons made it impossible to measure $^{3}J_{HH}$ values from the P.E.COSY spectrum. We therefore used a ^{13}C-filtered TOCSY experiment to measure the $^{3}J_{CH}$ values in both compounds 1 and 2. These heteronuclear vicinal coupling constants measured with ^{13}C in natural abundance in conjunction with measured interproton NOE intensities indicate that these compounds share a common C8 ring backbone conformation.

24670 (LA–12893-C, pp. 340) **Sequence-specific ^{1}H, ^{13}C, and ^{15}N resonance assignments for intestinal fatty-acid-binding protein complexed with palmitate (15.4 kDa).** Hodsdon, M.E. (Washington Univ. School of Medicine, St. Louis, MO (United States)); Toner, J.J.; Cistola, D.P. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Intestinal fatty-acid-binding protein (I-FABP) belongs to a family of soluble, cytoplasmic proteins that are thought to function in the intracellular transport and trafficking of polar lipids. Individual members of this protein family have distinct specificities and affinities for fatty acids, cholesterol, bile salts, and retinoids. We are comparing several retinol- and fatty-acid-binding proteins from intestine in order to define the factors that control molecular recognition in this family of proteins. We have established sequential resonance assignments for uniformly ^{13}C/^{15}N-enriched I-FABP complexed with perdeuterated palmitate at pH7.2 and 37°C. The assignment strategy was similar to that introduced for calmodulin. We employed seven three-dimensional NMR experiments to establish scalar couplings between backbone and sidechain atoms. Backbone atoms were correlated using triple-resonance HNCO, HNCA, TOCSY-HMQC, HCACO, and HCA(CO)N experiments. Sidechain atoms were correlated using CC-TOCSY, HCCH-TOCSY, and TOCSY-HMQC. The correlations of peaks between three-dimensional spectra were established in a computer-assisted manner using NMR COMPASS (Molecular Simulations, Inc.) Using this approach, ^{1}H, ^{13}C, and ^{15}N resonance assignments have been established for 120 of the 131 residues of I-FABP. For 18 residues, amide ^{1}H and ^{15}N resonances were unobservable, apparently because of the rapid exchange of amide protons with bulk water at pH 7.2. The missing amide protons correspond to distinct amino acid patterns in the protein sequence, which will be discussed. During the assignment process, several sources of ambiguity in spin correlations were observed. To overcome this ambiguity, the additional interresidue correlations often observed in the HNCA experiment were used as cross-checks for the sequential backbone assignments.

24671 (LA–12893-C, pp. 341) **Biosynthetic incorporation of telluromethionine into dihydrofolate reductase and crystallographic analysis of the distribution of tellurium atoms in the protein molecule.** Kunkle, M.G. (Univ. of South Carolina, Columbia, SC (United States)); Lewinski, K.; Boles, J.O.; Dunlap, R.B.; Odom, J.D.; Lebioda, L. Los Alamos National Lab., NM (United States). Dec 1994. Grant GM 342907. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Recent successes in crystallographic studies of proteins with methionine (Met) residues replaced with SeMet, pioneered by Hendrickson and coworkers, inspired us to replace Met with TeMet in Escherichia coli dihydrofolate reductase (DHFR). E. coli DHFR, which catalyzes the NADPH-dependent reduction of dihydrofolate to tetrahydrofolate, consists of 159 residues, 5 of which are Met. TeMet was incorporated into DHFR using the Met auxotroph, E. coli DL41, carrying the expression vector pWT8 with an IPTG inducible promoter and ampicillin resistance gene. The enzyme was purified by successive chromatography on Q-Sepharose and PHenyl Sepharose resins, yielding milligram quantities of homogeneous enzyme with a specific activity of 40 units/mg. TeMet DHFR exhibits kinetic properties similar to those of wt DHFR. Amino acid analysis indicated 3 authentic Met residues in TeMet DHFR, whereas atomic absorption spectroscopy detected 2 Te per protein

molecule. Amino acid sequence analysis results suggested that only authentic Met was present in the first three Met positions (1,16,and 20). Crystals of Te-DHFR were grown in the presence of methotrexate from PEG 4000 and were isomorphous with wt-DHFR crystals grown from ethanol. Difference Fourier maps and restrained least-squares refinement show very little, if any, Te in the first three Met positions: Met^1, Met^{16}, and Met^{20}, whereas the occupancy of Te in positions 42 and 92 is 0.64. Apparently, the process of folding, subsequent purification, and crystallization select DHFR molecules with Te in Met^{42} and Met^{92}. Replacing Met with TeMet provides an internal probe that should facilitate structural and mechanistic studies of proteins.

24672 (LA–12893-C, pp. 342) **Stereospecific assignments of glycine in proteins by stereospecific deuteration and ^{15}N labeling.** Hansen, A.P. (Ohio State Univ., Columbus, OH (United States)); Curley, R.W. Jr.; Panigot, M.J.; Fesik, S.W. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Stereospecific assignments are important for accurately determining the three-dimensional structures of proteins through the use of multidimensional NMR techniques. It is especially important to stereospecifically assign the glycine α-protons in proteins because of the potential for different backbone conformations of this residue. These stereospecific assignments are critical for interpreting the $^3J_{NH,\alpha H}$ coupling constants and NOEs involving the glycine α-protons that determine the conformation of this part of the protein. However, it is often difficult to unambiguously obtain the stereospecific assignments for glycine residues by using only NOE data. In this poster, we present a method for unambiguous, stereospecific assignment of the α-protons of glycine residues. This method involves synthesis of stereo-specifically deuterated and ^{15}N-labeled Gly using a slightly modified procedure originally described by Woodard and coworkers for the stereoselective deuteration of glycine. The stereospecifically deuterated and ^{15}N-labeled Gy has been incorporated into recombinant proteins expressed in both bacterial systems (FKBP) and mammalian cells (u-PA). Two- and three-dimensional isotope-filtered and isotope-edited NMR experiments were used to obtain the stereospecific assignments of the glycine α-protons for these proteins.

24673 (LA–12893-C, pp. 343) **Uniform ^{15}N- and $^{15}N/^{13}C$-labeling of proteins in mammalian cells and solution structure of the amino terminal fragment of u-PA.** Hansen, A.P. (Abbott Laboratories, Abbott Park, IL (United States)); Petros, A.M.; Meadows, R.P.; Mazar, A.P.; Nettesheim, D.G.; Pederson, T.M.; Fesik, S.W. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Urokinase-type plasminogen activator (u-PA) is a 54-kDa glycoprotein that catalyzes the conversion of plasminogen to plasmin, a broad-specificity protease responsible for the degradation of fibrin clots and extracellular matrix components. The u-PA protein consists of three individual modules: a growth factor domain (GFD), a kringle, and a serine protease domain. The amino terminal fragment (ATF) includes the GFD-responsible for u-PA binding to its receptor-and the kringle domains. This protein was expressed and uniformly ^{15}N-and $^{15}N/^{13}C$-labeled in mammalian cells by methods that will be described. In addition, we present the three-dimensional structure of ATF that was derived from 1299 NOE-derived distance restraints along with the ϕ angle and hydrogen bonding restraints. Although the individual domains in the structures were highly converged, the two domains are structurally independent. The overall structures of the individual domains are very similar to the structures of homologous proteins. However, important structural differences between the growth factor domain of u-PA and other homologous proteins were observed in the region that has been implicated in binding the urokinase receptor. These results may explain, in part, why other growth factors show no appreciable affinity for the urokinase receptor.

24674 (LA–12893-C, pp. 346) **Structural studies on leukaemia inhibitory factor.** Norton, R.S. (Biomolecular Research Institute, Parville (Australia)); Maurer, T.; Smith, D.K.; Nicola, N.A. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Leukaemia Inhibitory Factor (LIF) is a pleiotropic cytokine that acts on a wide range of target cells, including mega-karyocytes, osteoblasts, hepatocytes, adipocytes, neurons, embryonic stem cells, and primordial germ cells. Many of its activities are shared with other cytokines, particularly interleukin-6, oncostatin-M, ciliary neurotrophic factor, and granulocyte colony-stimulating factor (G-CSF). Although secreted in vivo as a glycoprotein, nonglycosylated recombinant protein expressed in E. coli is fully active and has been used in our nuclear magnetic resonance (NMR) studies of the three-dimensional structure and structure-function relationships of LIF. With 180 amino acids and a molecular mass of about 20 kDa, OF is too large for direct structure determination by two-dimensional and three-dimensional ^{1}HNMR. It is necessary to label the protein with the stable isotopes ^{15}N and ^{13}C and employ heteronuclear three-dimensional NMR in order to resolve and interpret the spectral information required for three-dimensional structure determination. This work has been undertaken with both human LIF and a mouse-human chimaera that binds to the human LIF receptor with the same affinity as the human protein and yet expresses in E. coli at much higher levels. Sequence-specific resonance assignments and secondary structure elements for these proteins will be presented and progress towards determination of their three-dimensional structures described.

24675 (LA–12893-C, pp. 347) **Measurement of CO_2 and N_2O at nanomolar amounts using continuous-flow isotope-ratio mass spectrometry (CF-IRMS).** Patel, A (Univ. of Dundee (United Kingdom)); Downie, S.; Webster, E.; Hopkins, D.W.; Rennie, M.J. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

We are currently developing methods using Continuous Flow Isotope Ratio Mass Spectrometry (CF-IRMS) in conjunction with a thermal desorption purification unit to measure nanomolar levels of $C0_2$ and N_20. Samples of the pure gases diluted in He/air and transferred to septum capped Exetainers (Labco) provided a simple means to investigate the technique. We analyzed $C0_2$ at natural abundance in the concentration range 50 to 5 nmoles and N_20 at two concentrations between 25 and 5 nmoles. The technique was then used to measure $C0_2$ (natural abundance and ^{13}C-labeled) generated from the ninhydrin reaction. The results are summarized in a table; values are expressed in delta ^{13}C notation relative to Pee Dee Belemnite. The data show that, provided care is taken to minimize or eliminate sources of contamination (air leaks, etc.), CF-IRMS coupled with a thermal desorption unit permits measurement of ^{13}C enrichment in much smaller amounts of isolated amino acids than has been possible until now. The new methodology, including thermal desorption, should allow stable-isotope investigations on much smaller samples than are possible with other currently available techniques-while maintaining high precision.

24676 (LA–12893-C, pp. 348) **Mechanism of phosphoryl transfer and protein-protein interaction in the PTS system-an**

NMR study. Rajagopal, P. (Univ. of Washington, Seattle, WA (United States)); Klevit, R.E. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228--: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

HPr and Enzyme IIA^{Glc} are two of the components of the bacterial PTS (phosphoenolpyruvate: sugar phosphotranferase system) and are involved in the phosphorylation and concomitant translocation of sugars across the membrane. These PTS protein complexes also regulate sugar transport. HPr, phosphorylated at a histidine N1 site by Enzyme I and phosphoenol pyruvate, transfers the phosphoryl group to a histidine N3 position in Enzyme IIA^{Glc}. HPrs from Gram-positive bacteria undergo regulatory phosphorylation at Ser^{46}, whereby phosphorylation of the histidine residue is inhibited. Conversely, histidine phosphorylation inhibits phosphorylation at Ser^{46}. HPrs from Gram-negative bacteria possess a serine residue at position 46, but do not undergo regulatory phosphorylation. HPr forms an open-faced sandwich structure with a four-strand S-sheet and 2 to 3 helices lying on top of the sheet. The active-site histidine and Ser^{46} occur in conformationally flexible regions. P-His-HPr from the Gram-positive bacterium Bacillus subtilus has been investigated by both homonuclear and heteronuclear two-dimensional and three-dimensional NMR experiments using an in-situ enzymatic regeneration system to maintain a constant level of P-His-HPr. The results show that localized conformational changes occur in the vicinity of the active-site histidine and also near Ser^{46}. HPr-Enzyme IIA^{Glc} complexes from both Bacillus subtilis and Gram-negative Escherichia coli were also studied by a variety of ^{15}N-edited two-dimensional NMR experiments, which were performed on uniformly ^{15}N-labeled HPr complexed to unlabeled Enzyme IIA^{Glc}. The complex is in fast exchange with a molecular weight of about 27 kDa. The focus of our work is to assess the changes undergone by HPr (the smaller of the two components), and so all the experiments were performed with excess Enzyme IIA present in the system.

24677 (LA–12893-C, pp. 350) **Synthesis and applications of ^{13}C glycerol.** Stocking, E. (Los Alamos National Laboratory, NM (United States)); Khalsa, O.; Martinez, R.A.; Silks, L.A. III. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228--: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Due in part to the use of labeled glycerol for the ^{13}C enrichment of biomolecules, we are currently developing new synthetic routes to various isotopomers of glycerol. Judging from our experience, traditional methods of glycerol synthesis are not easily adapted for isotopic enrichment and/or have poor overall yields (12 to 15%). Furthermore, the use of glycerol for enrichment can be prohibitively expensive and its availability is limited by the level of demand. We are presently developing a short de novo synthesis of glycerol from carbon dioxide (~53% overall yield for four steps) and are examining the feasibility of synthesizing site-specific ^{13}C-labeled glycerol and dihydroxyacetone (DHA) from labeled methanol and carbon dioxide. One application of ^{13}C glycerol we have examined is enzymatic conversion of glycerol to glyceraldehyde-3-monophosphate or dihydroxyacetone monophosphate (DHAP) with yields ranging from 25 to 50% (as determined by NMR spectroscopy). We are also pursuing the chemical conversion of ^{13}C-labeled DHA to DHAP. We are especially interested in ^{13}C-labeled DHAP because we are investigating its use as a chemo-enzymatic precursor for both labeled 2-deoxyribose and 2-deoxyribonucleic acids.

24678 (LA–12893-C, pp. 352) **Mechanistic studies of 3-deoxy-D-manno-octulosonic acid 8-phosphate synthase.** Dotson, G.D. (Univ. of Michigan, Ann Arbor, MI (United States)); Woodard, R.W. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228--: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

The enzyme 3-deOXY-D-manno-octulosonic acid 8-phosphate synthase (KDO 8-P synthase) catalyses the condensation of arabinose 5-phosphate (A 5-P) with phosphoenolpyruvate (PEP) to give the unique eight-carbon acidic sugar 3-deoxy-D-nianno-octulosonic acid 8-phosphate (KDO 8-P) found only in gram-negative bacteria and required for lipid A maturation and cellular growth. The E. coli gene kdsA that encodes KDO 8-P synthase has been amplified by standard PCR methodologies. The synthetic gene, subcloned into the expression vector pT7-7 was used to infect E. coli BL 21 (DE 3). Purification of crude supernatant from this transformant on Q Sepharose yields >200 mg of near-homogeneous KDO 8-P synthase per liter of cell culture. To explore the mechanism of KDO 8-P synthase, we prepared (E)- and (Z)-(3-^2H)PEP, (2-^{13}C)PEP, and (2-^{13}C,^{18}O)PEP chemically from the appropriately labeled 3-bromopyruvates by reaction with trimethylphosphite under Perkow reaction conditions. Our ^1H-NMR analysis of the stereochemistry at C3 of the KDO 8-Ps, obtained by separate incubation of (E)- and (Z)-(3-^2H)PEP with A 5-P in the presence of KDO 8-P synthase, demonstrated that the reaction is stereospecific with respect to both the C3 of PEP and the C1 carbonyl of A 5-P. (Z)-(3-^2H)PEP gave predominantly (3S)-(3^2H)KDO 8-P and (E)-(3-^2H)PEP gave predominantly (3R)-(3^2H)KDO-8P, which indicates condensation of the si face of PEP upon the re face of A 5-P-an orientation analogous to that seen with the similar aldehyde lyase DAH 7-P synthase. The fate of the enolic oxygen of (2-^{13}C, ^{18}O)PEP, during the course of the KDO 8-P synthase-catalyzed reaction as monitored by both ^{13}C- and ^{31}P-NMR spectroscopy demonstrated that the inorganic phosphate (Pi) and not the KDO 8-P contained the ^{18}O.

24679 (LA–12893-C, pp. 354) **Heteronuclear cross-polarization in multinuclear multidimensional NMR: Prospects for triple-resonance CP.** Majumdar, A. (Univ. of Michigan, Ann Arbor, MI (United States)); Zuiderweg, E.R.P. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228--: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Heteronuclear multiple-pulse-based Cross Polarization (HECP) between scalar coupled spins is gaining an important role in high-resolution multidimensional NMR of isotopically labeled biomolecules, especially in experiments involving net magnetization transfer. It has generally been observed that in these situations, the performance of HECP is superior to that of INEPT-based sequences. In particular, HECP-based three-dimensional HCCH spectroscopy is more efficient than the INEPT version of the same experiment. Differences in sensitivity have been intuitively attributed to relaxation effects and technical factors such as radiofrequency (rf) inhomogeneity We present theoretical analyses and computer simulations to probe the effects of these factors. Relaxation effects were treated phenomenologically; we found that relaxation differences are relatively small (up to 25%) between pulsed-free-precession (INEPT) and HECP-although always in favor of HECP. We explored the rf effects by employing a Gaussian distribution of rf amplitude over sample volume. We found that inhomogeneity effects significantly favor HECP over INEPT, especially under conditions of "matched " inhomogeneity in the two rf coils. The differences in favor of HECP indicate that an extension of HECP to triple resonance experiments (TRCP) in I -> S -> Q net transfers might yield better results relative to analogous INEPT-based net transfers. We theoretically analyze the possibilities of TRCP and find that transfer functions are critically dependent on the ratio J_{IS}/J_{SQ}. When J_{IS} equals J_{SQ}, we find that 100% transfer is possible for truly simultaneous TRCP and this transfer is obtained in a time 1.41 /J. The TRCP time requirement compares favorably with optimally concatenated INEPT-transfers, where net transfer I -> S -> Q is complete at 1.5 /J.

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Refer also to citation(s) 23421, 23718, 24641, 24642, 24663, 24668

24680 (CONF-9306417–Summ.) **Report of the first International workshop on human chromosome 14 mapping 1993.** Cox, D.W. National Insts. of Health, Bethesda, MD (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI02-93ER61624. From 1. international chromosome 14 workshop; Toronto (Canada); 9-12 Jun 1993. Order Number DE95012828. Source: OSTI; NTIS; GPO Dep.

The first International Workshop on Human Chromosome 14 mapping was held at Novotel in Toronto, Canada on June 9-12, 1993. There were 23 participants from nine countries. The goals of the workshop were to compile physical maps and a consensus linkage map, to consolidate available data on disease loci, to catalogue and facilitate distribution of resources and to encourage new collaborations and data sharing.

24681 (DOE/ER/13602–7) **HSP101 gene from soybean. Progress report, August 16, 1989–August 15, 1992.** Key, J.L. Georgia Univ., Athens, GA (United States). Research Foundation. [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-86ER13602. Order Number DE95014493. Source: OSTI; NTIS; GPO Dep.

The major research activities proposed for the renewal period were focused on defining regulatory mechanisms operative in the heat shock response and assessing the mechanism of HS-induced thermotolerance.

24682 (DOE/ER/61792–1) **The role of patents in technology transfer in Human Genome Project. Progress report.** Eisenberg, R.S. Michigan Univ., Ann Arbor, MI (United States). 4 Apr 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-94ER61792. Order Number DE95012425. Source: OSTI; NTIS; GPO Dep.

Studies of the effectiveness of patents in promoting the commercial development of products emanating from federally-sponsored research in the Human Genome Project are described.

24683 (LA–12893-C, pp. 43-57) **Complex DNA structures and structures of DNA complexes.** Chazin, W.J. (Scripps Research Institute, La Jolla, CA (United States)); Carlstroem, G.; Shiow-Meei Chen; Miick, S.; Gomez-Paloma, L.; Smith, J.; Rydzewski, J. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Complex DNA structures (for example, triplexes, quadruplexes, junctions) and DNA-ligand complexes are more difficult to study by NMR than standard DNA duplexes are because they have high molecular weights, show nonstandard or distorted local conformations, and exhibit large resonance linewidths and severe ^{1}H spectral overlap. These systems also tend to have limited solubility and may require specialized solution conditions to maintain favorable spectral characteristics, which adds to the spectroscopic difficulties. Furthermore, with more atoms in the system, both assignment and structure calculation become more challenging. In this article, we focus on demonstrating the current status of NMR studies of such systems and the limitations to further progress; we also indicate in what ways isotopic enrichment can be useful.

24684 (LA–12893-C, pp. 105-125) **Synthesis and NMR of ^{15}N-labeled DNA fragments.** Jones, R.A. (Rutgers, The State Univ. of New Jersey, Piscataway, NJ (United States)). Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

DNA fragments labeled with ^{15}N at the ring nitrogens and at the exocyclic amino groups can be used to obtain novel insight into interactions such as base pairing, hydration, drug binding, and protein binding. A number of synthetic routes to ^{15}N-labeled pyrimidine nucleosides, purines, and purine nucleosides have been reported. Moreover, many of these labeled bases or monomers have been incorporated into nucleic acids, either by chemical synthesis or by biosynthetic procedures. The focus of this chapter will be on the preparation of ^{15}N-labeled purine 2′-deoxynucleosides, their incorporation into DNA fragments by chemical synthesis, and the results of NMR studies using these labeled DNA fragments.

24685 (LA–12893-C, pp. 127-144) **New strategy for stable-isotope-aided, multidimensional NMR spectroscopy of DNA oligomers.** Ono, Okira (Tokyo Metropolitan Univ., Tokyo (Japan)); Tate, Shin-Ichi; Kainosho, Masatsune. Los Alamos National Lab., NM (United States). Dec 1994. Grant No. 05101004. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Nuclear Magnetic Resonance (NMR) is the most efficient method for determining the solution structures of biomolecules. By applying multidimensional heteronuclear NMR techniques to $^{13}C/^{15}N$-labeled proteins, we can determine the solution structures of proteins with molecular mass of 20 to 30kDa at an accuracy similar to that of x-ray crystallography. Improvements in NMR instrumentation and techniques as well as the development of protein engineering methods for labeling proteins have rapidly advanced multidimensional heteronuclear NMR of proteins. In contrast, multidimensional heteronuclear NMR studies of nucleic acids is less advanced because there were no efficient methods for preparing large amounts of labeled DNA/RNA oligomers. In this report, we focused on the chemical synthesis of DNA oligomers labeled at specific residue(s). RNA oligomers with specific labels, which are difficult to synthesize by the enzyme method, can be synthesized by the chemical method. The specific labels are useful for conformational analysis of larger molecules such as protein-nucleic acid complexes.

24686 (LA–12893-C, pp. 145-155) **^{13}C relaxation in an RNA hairpin.** King, G.C. (Univ. of South Wales, Kensington (Australia)); Akratos, C.; Xi, Z.; Michnica, M.J. Los Alamos National Lab., NM (United States). Dec 1994. Grant RR-05759. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

This initial survey of ^{13}C relaxation in the △TAR RNA element has generated a number of interesting results that should prove generally useful for future studies. The most readily comparable study in the literature monitored ^{13}C relaxation of the methyl groups from unusual bases in $tRNA^{Phe}$. The study, which used T_1 and NOE data only, reported order parameters for the methyl group axis that ranged between 0.51 and 0.97-a range similar to that observed here. However, they reported a breakdown of the standard order parameter analysis at higher (118-MHz ^{13}C) frequencies, which should serve to emphasize the need for a thorough exploration of suitable motional models.

24687 (LA–12893-C, pp. 189-195) **NMR studies of isotopically labeled RNA.** Pardi, A. (Univ. of Colorado, Boulder, CO (United States)). Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

In summary, the ability to generate NMR quantities of ^{15}N and ^{13}C-labeled RNAs has led to the development of heteronuclear

multi-dimensional NMR techniques for simplifying the resonance assignment and structure determination of RNAs. These methods for synthesizing isotopically labeled RNAs are only several years old, and thus there are still relatively few applications of heteronuclear multi-dimensional NMR techniques to RNA. However, given the critical role that RNAs play in cellular function, one can expect to see an increasing number of NMR structural studies of biologically active RNAs.

24688 (LA–12893-C, pp. 247-261) **RNA structure and scalar coupling constants.** Tinoco, I. Jr. (Univ. of California, Berkeley, CA (United States)); Cai, Z.; Hines, J.V.; Landry, S.M.; SantaLucia, J. Jr.; Shen, L.X.; Varani, G. Los Alamos National Lab., NM (United States). Dec 1994. DOE Contract FG03-86ER60406 ; FG05-86ER75281. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Signs and magnitudes of scalar coupling constants-spin-spin splittings-comprise a very large amount of data that can be used to establish the conformations of RNA molecules. Proton-proton and proton-phosphorus splittings have been used the most, but the availability of ^{13}C-and ^{15}N-labeled molecules allow many more coupling constants to be used for determining conformation. We will systematically consider the torsion angles that characterize a nucleotide unit and the coupling constants that depend on the values of these torsion angles. Karplus-type equations have been established relating many three-bond coupling constants to torsion angles. However, one- and two-bond coupling constants can also depend on conformation. Serianni and coworkers measured carbon-proton coupling constants in ribonucleosides and have calculated their values as a function of conformation. The signs of two-bond coupling can be very useful because it is easier to measure a sign than an accurate magnitude.

24689 (LA–12893-C, pp. 337) **Synthesis and biosynthesis of ^{13}C-, ^{15}N-labeled deoxynucleosides useful for biomolecular structural determinations.** Ashburn, D.A. (Los Alamos National Laboratory, NM (United States)); Garcia, K.; Hanners, J.L.; Silks, L.A. III; Unkefer, C.J. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Currently, there is a great emphasis on elucidating the structure, function, and dynamics of DNA. Much of the research involved in this study uses nuclear magnetic resonance (NMR) spectroscopy. Effective use of NMR spectroscopy for DNA molecules with mw > 10,000 requires stable isotope enrichment. We present strategies for site-specific isotopic labeling of the purine bases adenosine and guanosine and the biosynthesis of (U-^{13}C, ^{15}N) DNA from methylotropic bacteria. With commercially available 6-chloropurine, an effective two-step route leads to 2′-deoxy-(amino-^{15}N)adenosine (dA). The resulting d(amino-^{15}N)A is used in a series of reactions to synthesize 2′-deoxy-(2-^{13}C,1,amino-$^{15}N_2$)guanosine or any combination thereof. An improved biosynthesis of labeled DNA has been accomplished using Methylobacterium extorquens AS1. Each liter of growth medium contains 4 g of methanol to yield 1 g of lyophilized cells. As much as 200 mg of RNA per liter of culture has been obtained. We are currently developing large-scale isolation protocols. General synthetic pathways to oligomeric DNA will be presented.

24690 (LA–12893-C, pp. 339) **Structural studies on an internal loop from a hairpin ribozyme.** Cai, Z. (Univ. of California, Berkeley, CA (United States)); SantaLucia, J. Jr.; Tinoco, I. Jr. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Ribozymes, RNA enzymes, catalyze site-specific RNA cleavage and ligation reactions. We are studying the three-dimensional structure of a hairpin ribozyme derived from the minus strand of tobacco ring spot virus satellite RNA ((-)sTRSV), which has been engineering to specifically cleave the HIV-1 RNA. The minimum structure for the catalytic reaction involves a 50-nucleotide ribozyme and a 14-nucleotide substrate. The proposed secondary structure of the ribozyme-substrate complex consists of four short helices separated by two internal loops. The relatively large size (64-nucleotide) of the ribozyme-substrate complex presents formidable problems in solving the structure using NMR. Therefore we are studying smaller structural subunits of the complex. We are determining the high resolution structure of the symmetric internal loop involving the cleavage site and the flanking helices. One strand of the internal loop was selectively ^{13}C-labeled at C8 of each purine and C6 of each pyrimidine. By using ^{13}C-edited two-dimensional NMR, the proton NOESY spectrum was greatly simplified. This allowed unambiguous sequential proton resonance assignments along each strand. Three-dimensional ^{1}-^{13}C HMQC-NOESY was used to further facilitate resonance assignments. We are also enzymatically synthesizing the entire 50-nucleotide ribozyme and will combine it with the ^{13}C-labeled substrate. Through comparison of the NOE connectivities of the labeled nucleotides from the internal loop alone with those from the entire complex, the differences between the two structures can be elucidated.

24691 (LA–12893-C, pp. 344) **NMR studies of two spliced leader RNAs using isotope labeling.** Lapham, J. (Yale Univ., New Haven, CT (United States)); Crothers, D.M. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Spliced leader RNAs are a class of RNA molecules (<200 nts) involved in the trans splicing of messenger RNA found in trypanosomes, nematodes, and other lower eukaryotes. The spliced leader RNA from the trypanosome Leptomonas Collosoma exists in two alternate structural forms with similar thermal stabilities. The 54 nucleotides on the 5′ end of the SL molecule is structurally independent from the 3′ half of the RNA, and displays the two structural forms. Furthermore, the favored of the two structures was shown to contain anomalous nuclease sensitivity and thermal stability features, which suggests that there may be tertiary interactions between the splice site and other nucleotides in the 5′ end. Multidimensional NMR studies are underway to elucidate the structural elements present in the SL RNAs that give rise to their physical properties. Two spliced leader sequences have been studied. The first, the 54 nucleotides on the 5′ end of the L. Collosoma sequence, was selected because of earlier studies in our laboratory. The second sequence is the 5′ end of the trypanosome Crithidia Fasciculata, which was chosen because of its greater sequence homology to other SL sequences. Given the complexity of the NMR spectra for RNA molecules of this size, we have incorporated $^{15}N/^{13}C$-labeled nucleotides into the RNA. One of the techniques we have developed to simplify the spectra of these RNA molecules is isotope labeling of specific regions of the RNA. This has been especially helpful in assigning the secondary structure of molecules that may be able to adopt multiple conformations. Using this technique one can examine a part of the molecule without spectral interference from the unlabeled portion. We hope this approach will promote an avenue for studying the structure of larger RNAs in their native surroundings.

24692 (LA–12893-C, pp. 345) **Application of heteronuclear couplings to conformational analysis of oligonucleotides.** Zhu, G. (Univ. of Maryland, College Park, MD (United States)); Live, D.; Bax, A. Los Alamos National Lab., NM (United States). Dec 1994.

(CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

The value of vicinal coupling constants extracted from NMR spectra in deducing torsion angles for conformational analysis is well recognized. Due to the abundance of protons, their couplings have been mostly widely used. In many instances, couplings between protons and other nuclei may be a valuable complement to proton-proton couplings or, in some instances, may be the only coupling available to characterize the torsion angle about a bond. Recently, heteronuclear couplings have been used to great benefit in studies of isotopically enriched proteins, and this general approach has been extended to peptides at natural abundance. The possibility of using this approach to study oligonucleotides is also attractive but has not as yet been widely exploited. With the development of strategies for labeling such molecules, particularly RNAs, this may become an important component in conformational analysis. For DNA, labeling is less accessible, but sufficient quantities of unlabeled material are readily available for measuring these couplings at natural abundance. We chose several DNA systems to explore the usefulness of heteronuclear couplings in addressing the sugar conformation and the glycosidic torsion angle. Intensities of cross peaks in long-range HMQC experiments can be related to the couplings. Crosspeaks involving H1′ and C1′ atoms have been emphasized because of the superior shift dispersion at these positions between sugar protons and carbon atoms. Results will be shown for the self-complementary Dickerson duplex dodecamer sequence d(CGCGAATTCGCG) and for d(GGTCGG), which dimerizes to form a G-tetrad structure incorporating both syn and anti base orientations. The couplings provide a clear discrimination between presence of C3′-endo and C2′-endo conformations of the sugars and syn and anti bases arrangements.

24693 (LA–12893-C, pp. 349) **Synthesis and applications of selectively ^{13}C-labeled RNA.** SantaLucia, J. Jr. (Univ. of California, Berkeley, CA (United States)); Shen, L.X.; Lewis, H.; Cai, Z.; Tinoci, I. Jr. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Spectral overlap is a substantial problem in NMR studies of RNA molecules >30 nucleotides. To overcome this difficulty, we synthesized selectively ^{13}C-labeled RNAs and adapted several isotope-edited two- and three-dimensional NMR experiments originally developed for protein studies. We optimized protocols for synthesis of multi-gram quantities of CTP, UTp, ATP, and GTP using a combination of synthetic organic and enzymatic methods. Uracil is prepared in 40 to 50% yield from ^{13}C-cyanide in two steps. Using acetyl- tribenzoyl-ribose and standard chemistry uracil is then attached to the sugar (90% yield). The tribenzoyl-uridine intermediate is converted into uridine or cytidine quantitatively, depending on the deblocking protocol. Labeled purines are synthesized using simple pyrimidine precursors and reacting with ^{13}C-formic acid (80% yield). Purine nucleosides are then synthesized using uridine phosphorylase and purine nucleoside phosphorylase. The nucleosides were converted to NMPs by treatment with $POCl_3$ in triethylphosphate. We converted NMPs to NTPs by standard enzymatic methods. Selectively labeled RNAs were synthesized by run-off transcription using ^{13}C-labeled NTPs. Several different strategies help solve over-lap problems in larger RNAs. Isotope-edited two-dimensional NMR experiments such as ω1-1/2 X-filtered NOESY simplify NMR spectra by dividing the normal NOESY spectrum into two subspectra-one involving NOEs from protons bound to ^{12}C and one from protons bound to ^{13}C. For example, we labeled A and U residues of a 34-nucleotide pseudoknot, and the ^{12}C subspectrum of the 1/2 X-filtered NOESY contained NOEs only from G and C residues (along with adenine 2H); the ^{13}C subspectrum contained NOEs only from A and U residues. Each subspectrum has less overlap than the NOESY of an unlabeled sample; the editing strategy allows each resonance to be identified by residue type (A, C, G, or U).

24694 (LA–12893-C, pp. 351) **Ner protein of phage Mu: Assignments using ^{13}C/^{15}N-labeled protein.** Strzelecka, T. (National Institutes of Health, Bethesda, MD (United States)); Gronenborn, A.M.; Clore, G.M. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

The Ner protein is a small (74-amino acid) DNA-binding protein that regulates a switch between the lysogenic and lytic stages of phage Mu. It inhibits expression of the C repressor gene and down-regulates its own expression. Two-dimensional NMR experiments on uniformly ^{15}N-labeled protein provided most of the backbone and some of the sidechain proton assignments. The secondary structure determination using two-dimensional NOESY experiments showed that Ner consists of five α-helices. However, because most of the sidechain protons could not be assigned, the full structure was not determined. Using uniformly ^{13}C/^{15}N-labeled Ner and a set of three-dimensional experiments, we were able to assign all of the backbone and 98% of the sidechain protons. In particular, the CBCANH and CBCA(CO)NH experiments were used to sequentially assign the Cα and Cβ resonances; the HCCH-CTOCSY and HCCH-COSY were used to assign sidechain carbon and proton resonances.

24695 (LA–12893-C, pp. 353) **NMR studies of bent DNA using ^{13}C-enriched samples.** Zimmer, D.P. (Yale Univ., New Haven, CT (United States)); Crothers, D.M. Los Alamos National Lab., NM (United States). Dec 1994. (CONF-9403228–: Stable isotope applications in biomolecular structure and mechanisms, Santa Fe, NM (United States), 27-31 Mar 1994). In *Stable isotope applications in biomolecular structure and mechanisms. A meeting to bring together producers and users of stable-isotope-labeled compounds to assess current and future needs.* 382p. Order Number DE95012795. Source: OSTI; NTIS; INIS; GPO Dep.

Bending of the DNA double helix can be brought about by introducing runs of adenines (A-tracts) in phase with the helical repeat of the DNA. The requirements for bending of DNA by A-tracts are that the length of the A-tract be greater than 3 base pairs and that the A-tracts must be in phase with the helical repeat (every 10 or 11 bp). Other factors, such as the number of adenines in the run, flanking sequences, and whether the A-tracts are phased with respect to the 5′A or the 3′A, have effects upon the degree of bending as assayed by electrophoretic mobility on native polyacrylamide gels. There are a number of models for bending A-tract DNA. The junction-bending model postulates that the structure of A-tracts is similar to the fiber diffraction structure of poly A, in which there is a significant degree of base pair tilt with respect to the helix axis. In this model, bending occurs at the junction between the A-tract and the B-form helix to allow favorable stacking interactions to occur. The bend of the helix could arise as a result of some other perturbation of B-form DNA by A-tracts, such as propeller twist; bending also could be due to a combination of factors. Our goal is to find the structural features of A-tracts responsible for bending of the helix by performing NMR on oligonucleotides containing A-tracts to obtain higher resolution structural data. One of the problems encountered in NMR structure determination of nucleic acids and other macromolecules is the assignment of resonances to nuclei. This procedure can be greatly facilitated through the use of ^{13}C-enriched nucleic acid samples. We are developing a technique for the enzymatic synthesis of labeled DNA for NMR. The technique we are developing is similar to RNA labeling techniques already in use. The technique involves growth of methylotrophic bacteria on $^{13}CH_3OH$.

5505 Metabolism

Refer also to citation(s) 24607, 24643

24696 (DOE/ER/61252–T2) **CO_2 exchange, environmental productivity indices, and productivity of Agaves and Cacti under current and elevated atmospheric CO_2 concentrations. Terminal report.** California Univ., Los Angeles, CA (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-91ER61252. Order Number DE95013304. Source: OSTI; NTIS; GPO Dep.

The research described in the proposal investigated net CO_2 uptake and biomass accumulation for an extremely productive CAM plant, the prickly pear cactus Opuntia ficus-indica, under conditions of elevated CO_2 concentrations for relatively long periods. The influences of soil water status, air temperature, and the photosynthetic photon flux (PPF) on net CO_2 uptake over 24-h periods were evaluated to enable predictions to be made based on an Environmental Productivity Index (EPI). Specifically, EPI predicts the fraction of maximal daily net CO_2 uptake based on prevailing environmental conditions. It is the product of indices for temperature, soil water, and intercepted PPF, each of which range from 0.00 when that index factor completely inhibits net CO_2 uptake to 1.00 when no limitation occurs. For instance, the Water Index is 1.00 under wet conditions and decreases to 0.00 during prolonged drought. Although the major emphasis of the research was on net CO_2 uptake and the resulting biomass production for O. ficus-indica, effects of elevated CO_2 concentrations on root: shoot ratios and on the activities of the two carboxylating enzymes were also investigated. Moreover, experiments were also done on other CAM plants, including Agave deserti, Agave salmiana, and Hylocereus undatus, and Stenocereus queretaroensis.

5506 Medicine

Refer also to citation(s) 23409, 23724, 24714, 24730

24697 (BNL–61919) **Data resources for nuclear medicine.** Bhat, M.R. (Brookhaven National Lab., Upton, NY (United States)); Lemmel, H.D. Brookhaven National Lab., Upton, NY (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95014552. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this article is to list data resources needed for nuclear medicine and provide information on how to access them. This list will include publications of data compilations or evaluations, databases, and data processing codes for both nuclear structure and decay, as well as reaction data. Sources of bibliographic and related information on nuclear data are also be listed. The authors of this article have used their judgement in choosing a representative list of data sources; a more complete listing may be found in the references.

24698 (CONF-9505232–1) **Ligands for SPECT and PET imaging of muscarinic-cholinergic receptors of the heart and brain.** Knapp, F.F. Jr. (and others); McPherson, D.W.; Luo, H. Oak Ridge National Lab., TN (United States); George Washington Univ., Washington, DC (United States). [1995]. 36p. Sponsored by USDOE, Washington, DC (United States);National Insts. of Health, Bethesda, MD (United States). DOE Contract AC05-84OR21400 ; FG05-88ER60649. Grant No. NS-22215. From 5. Mediterranean symposium on nuclear medicine and radiopharmaceuticals - receptors; Athens (Greece); 23-28 May 1995. Order Number DE95012870. Source: OSTI; NTIS; GPO Dep.

Interest in the potential use of cerebral SPECT and PET imaging for determination of the density and activity of muscarinic-cholinergic receptors (mAChR) has been stimulated by the changes in these receptors which occur in many neurological diseases. In addition, the important involvement of mAChR in modulating negative inotropic cardiac activity suggests that such receptor ligands may have important applications in evaluation of changes which may occur in cardiac disease. In this paper, the properties of several key muscarinic receptor ligands being developed or which have been used for clinical SPECT and PET are discussed. In addition, the ORNL development of the new iodinated IQNP ligand based on QNB and the results of in vivo biodistribution studies in rats, in vitro competitive binding studies and ex vivo autoradiographic experiments are described. The use of radioiodinated IQNP may offer several advantages in comparison to IQNB because of its easy and high yield preparation and high brain uptake and the potential usefulness of the "partial" subtype selective IONP isomers. We also describe the development of new IQNP-type analogues which offer the opportunity for radiolabeling with positron-emitting radioisotopes (carbon-11, fluorine-18 and bromine-76) for potential use with PET.

24699 (CONF-9505232–2) **Interim report on intrathoracic radiotherapy of human small-cell lung carcinoma in nude mice with Re-188-RC-160, a radiolabeled somatostatin analogue.** Zamora, P.O. (Univ. of Bonn (Germany). Dept. of Nuclear Medicine); Bender, H.; Biersack, H.J.; Knapp, F.F. Jr. Oak Ridge National Lab., TN (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. Mediterranean symposium on nuclear medicine and radiopharmaceuticals - receptors; Athens (Greece); 23-28 May 1995. Order Number DE95014289. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this study was to evaluate the therapeutic efficacy of Re-188-RC-160 in experimental models of human small cell lung carcinomas which mimic the clinical presentation. In the experimental model, cells from the human small cell lung carcinoma cell line NCI-H69 cells were inoculated into the thoracic cavity of athymic mice and rats. Subsequently, the biodistribution of Re-188-RC-160 after injection into the pleural cavity, a radiolabeled somatostatin analogue, was monitored as was the effect on the subsequent growth of tumors. The results presented here, and which are a part of a larger series of studies, suggest that Re-188-RC-160 can be effectively used in this animal model to restrict the growth of small cell lung carcinoma in the thoracic cavity.

24700 (DOE/OR/00033–T641) **Manpower assessment brief: May 1995, No. 31.** Oak Ridge Inst. for Science and Education, TN (United States). 1995. 5p. Sponsored by USDOE, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE95015635. Source: OSTI; NTIS; GPO Dep.

The Health Physics/Radiation Protection Enrollments and Degrees, 1994 survey consisted of 53 institutions offering a major in health physics/radiation protection or radiation health, or an option program equivalent to a major (for example, in radiobiology or biophysics). Of the 53 programs, 1 program was new to the survey, 4 programs were suspended, allowing the students to complete their degrees, and 1 undergraduate program was suspended and reported the last degrees in 1994. As in previous years, adjustments have been made to prior years' data to reflect additional information or corrections received.

24701 (DOE/OR/00033–T656) **Health physics/radiation protection enrollments and degrees, 1994: Appendixes.** Oak Ridge Inst. for Science and Education, TN (United States). May 1995. 54p. Sponsored by USDOE, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE95015625. Source: OSTI; NTIS; INIS; GPO Dep.

This report consists of tables of data on training of health physicists in the United States principally over the decade of 1983–1993.

24702 (NUREG/CR–6125-Vol.1) **Human factors evaluation of remote afterloading brachytherapy: Human error and critical tasks in remote afterloading brachytherapy and approaches for improved system performance. Volume 1.** Callan, J.R. (Pacific Science and Engineering Group, San Diego, CA (United States)); Kelly, R.T.; Quinn, M.L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Technology; Pacific Science and Engineering Group, San Diego, CA (United States); University of California San Diego Medical Center, CA (United States). Div. of Radiation Oncology. May 1995. 215p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

Remote Afterloading Brachytherapy (RAB) is a medical process used in the treatment of cancer. RAB uses a computer-controlled

device to remotely insert and remove radioactive sources close to a target (or tumor) in the body. Some RAB problems affecting the radiation dose to the patient have been reported and attributed to human error. To determine the root cause of human error in the RAB system, a human factors team visited 23 RAB treatment sites in the US The team observed RAB treatment planning and delivery, interviewed RAB personnel, and performed walk-throughs, during which staff demonstrated the procedures and practices used in performing RAB tasks. Factors leading to human error in the RAB system were identified. The impact of those factors on the performance of RAB was then evaluated and prioritized in terms of safety significance. Finally, the project identified and evaluated alternative approaches for resolving the safety significant problems related to human error.

24703 (ORNL/TM–12965) **Nuclear medicine program progress report for quarter ending March 31, 1995.** Knapp, F.F. Jr.; Ambrose, K.R.; Beets, A.L.; Luo, H.; McPherson, D.W.; Mirzadeh, S. Oak Ridge National Lab., TN (United States). Jun 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013506. Source: OSTI; NTIS; GPO Dep.

In this report the conditions for "direct" labeling of the antigranulocyte (MAb) BW 250/183 monoclonal antibody with rhenium-188 (Re-188) from a generator are described. Re-188-BW 250/183 is of interest for potential use for bone marrow ablation. The labeling time, temperature, pH, and the amount of tin and citric acid were optimized utilizing IgG. Radiolabeling yields of greater than 97% were achieved using 1 mL of a phthalate/tartrate buffer (pH 5.M=?), 250 μ g BW 250/183, 1.0 mg citric acid, 400 μ g tin (II) chloride, and 1 mL of the tungsten-188/rhenium-188 generator eluent (200–800 μ Ci of Re-188). Analysis of the Re-188-labeled IgG and BW 250/183 was performed by Instant Thin Layer Chromatography (ITLC), Sephadex purification and High Performance Liquid Chromatography (HPLC). When the labeling was performed at room temperature or 37 C, in vitro stability studies performed in HSA solution, cysteine solution, 6 M urea solution and a 1% casein solution showed that the Re-188 label demonstrated a similar stability profile in all solutions. Initial studies indicate that Re-188-BW 250/183 retained ~ 90% of immunoreactivity when compared to the technetium-99m labeled antibody prepared from the same kit. During this period, several radioisotopes prepared in the ORNL HFIR were also supplied on a cost-recovery basis or provided to collaborators for ongoing collaborative projects. These include tin-117m, processed tungsten-188 and the ORNL alumina-based tungsten-188/rhenium-188 generators.

24704 (UCRL-JC–120641) **A computational method for comparing the behavior and possible failure of prosthetic implants.** Nielsen, C.; Hollerbach, K.; Perfect, S.; Underhill, K. Lawrence Livermore National Lab., CA (United States). May 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9509172–1: Engineering in Medicine and Biology Society (EMBS) conference, Montreal (Canada), 20-23 Sep 1995). Order Number DE95013431. Source: OSTI; NTIS; GPO Dep.

Prosthetic joint implants currently in use exhibit high Realistic computer modeling of prosthetic implants provides an opportunity for orthopedic biomechanics researchers and physicians to understand possible in vivo failure modes, without having to resort to lengthy and costly clinical trials. The research presented here is part of a larger effort to develop realistic models of implanted joint prostheses. The example used here is the thumb carpo-metacarpal (cmc) joint. The work, however, can be applied to any other human joints for which prosthetic implants have been designed. Preliminary results of prosthetic joint loading, without surrounding human tissue (i.e., simulating conditions under which the prosthetic joint has not yet been implanted into the human joint), are presented, based on a three-dimensional, nonlinear finite element analysis of three different joint implant designs.

5507 Microbiology

Refer also to citation(s) 23419, 23420, 24643

24705 (PNL-SA–26258) **Bench-scale/field-scale interpretations: Session overview.** Cunningham, A.B.; Peyton, B.M. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950483–4: 3. international symposium on in situ and on-site bioreclamation, San Diego, CA (United States), 24-27 Apr 1995). Order Number DE95014637. Source: OSTI; NTIS; INIS; GPO Dep.

In situ bioremediation involves complex interactions between biological, chemical, and physical processes and requires integration of phenomena operating at scales ranging from that of a microbial cell (10^{-6}) to that of a remediation site (10 to 1000 m). Laboratory investigations of biodegradation are usually performed at a relatively small scale, governed by convenience, cost, and expedience. However, extending the results from a laboratory-scale experimental system to the design and operation of a field-scale system introduces (1) additional mass transport mechanisms and limitations; (2) the presence of multiple phases, contants, and competing microorganisms (3) spatial geologic heterogeneities; and (4) subsurface environmental factors that may inhibit bacterial growth such as temperature, pH, nutrient, or redox conditions. Field bioremediation rates may be limited by the availability of one of the necessary constituents for biotransformation: substrate, contaminant, electron acceptor, nutrients, or microorganisms capable of degrading the target compound. The factor that limits the rate of bioremediation may not be the same in the laboratory as it is in the field, thereby leading, to development of unsuccessful remediation strategies.

24706 (UCRL-JC–120183) **Mechanisms of protein and virus crystal growth: An atomic force microscopy study of Canavalin crystallization.** Land, T.A. (Lawrence Livermore National Lab., CA (United States)); De Yoreo, J.J.; Malkin, A.J.; Kutznesov, Y.G.; McPherson, A. Lawrence Livermore National Lab., CA (United States). 10 Mar 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9506203–1: 6. ICCG, The Hague (Netherlands), 18-23 Jun 1995). Order Number DE95014365. Source: OSTI; NTIS; INIS; GPO Dep.

The evolution of surface morphology and step dynamics during growth of single crystals of the protein Canavalin and of the cubic satellite tobacco mosaic virus crystals (STMV) have been investigated by in situ atomic force microscopy. These two crystals were observed to grow by very different mechanisms. Growth of Canavalin occurs on complex vicinal hillocks formed by multiple, independently acting screw dislocations. Small cluster were observed on the terraces. STMV on the other hand, was observed to grow by 2D nucleation of islands. No dislocations were found on the crystal. The results are used to determine the growth mechanisms and estimate fundamental materials parameters. The images also illustrate the important mechanism of defect incorporation and provide insight to the processes that limit the growth rate and uniformity of these crystals.

5508 Morphology

24707 (UCRL-JC–120177) **Modeling of ablation by photospallation using the computer program PUFF/DFRACT.** Antoun, T. (SRI International, Menlo Park, CA (United States)); Seaman, L.; Glinsky, M.E. Lawrence Livermore National Lab., CA (United States). 1 Mar 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950226–51: SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine, San Jose, CA (United States), 5-14 Feb 1995). Order Number DE95011753. Source: OSTI; NTIS; GPO Dep.

In general, macroscopic material failure is a manifestation of irreversible changes at the microscopic level. Many tissues, which may appear to be macroscopically homogeneous, are, at a fundamental microscopic level, a composite material. For example, cornea is composed of a hyaluronic acid matrix in which layers of collagen fibers are overlaid in a crossing pattern. The points where the collagen fibers intersect are potential nucleation sites for microscopic defects, which under the action of tensile stress, nucleate, grow and coalesce to form macroscopic failure planes, or spall

planes. Using a model based on microstructural evolution, this paper examines the failure process during photoablation. Specifically, the paper describes a physically motivated, micromechanical model based on the nucleation and growth of spherical voids. This model is then used to simulate photoablation of cornea. Potential for using this model to predict the stress wave and material damage measured by experiment is discussed.

5509 Pathology

Refer also to citation(s) 24642

5510 Physiological Systems

24708 (PNL-SA–26069) **Adaptive life simulator: A novel approach to modeling the cardiovascular system.** Kangas, L.J. (and others); Keller, P.E.; Hashem, S. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950653–3: 1995 American control conference, Seattle, WA (United States), Jun 1995). Order Number DE95014634. Source: OSTI; NTIS; GPO Dep.

In this paper, an adaptive life simulator (ALS) is introduced. The ALS models a subset of the dynamics of the cardiovascular behavior of an individual by using a recurrent artificial neural network. These models are developed for use in applications that require simulations of cardiovascular systems, such as medical mannequins, and in medical diagnostic systems. This approach is unique in that each cardiovascular model is developed from physiological measurements of an individual. Any differences between the modeled variables and the actual variables of an individual can subsequently be used for diagnosis. This approach also exploits sensor fusion applied to biomedical sensors. Sensor fusion optimizes the utilization of the sensors. The advantage of sensor fusion has been demonstrated in applications including control and diagnostics of mechanical and chemical processes.

24709 (UCRL-ID–120740) **Spontaneous origin of topological complexity in the cerebral cortex.** Chapline, G. Lawrence Livermore National Lab., CA (United States). 7 Apr 1995. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011698. Source: OSTI; NTIS; GPO Dep.

Attention is drawn to the possibility of regarding the cerebral cortex as a physical system whose only excitations are topological. An attractive feature of such a hypothesis is that it is possible to understand how local dynamics could spontaneously give rise to a large scale organization of neurons and synapses that one might associate with sophisticated cognitive capabilities. It is suggested that the spontaneous appearance of topological disorder in the topological phases of 2-D and 4-D quantum gravity illustrates how the topological complexity of the human brain can develop. In particular the cooperative behavior of different neural circuits in the cerebral cortex may be closely related to the topology of certain 4-manifolds.

5520 Public Health

Refer also to citation(s) 24714, 24729, 24730

5530 Agriculture and Food Technology

Refer also to citation(s) 23417, 24625

24710 (CRIE-U–94011) **Development of technologies to prevent fish diseases by vaccination. 1. Adaptation of an ELISA to detect serum antibody and the effect of the vaccination for Japanese flounder.** Furuta, T. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Honda, H.; Kikuchi, K.; Iwata, N.; Kiyono, M. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Jul 1994. 24p. (In Japanese). Order Number DE95790541. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

An examination was carried out on the adaptation of an ELISA for flounder and on the preparation and effect of a protective vaccination against edwardsiellosis. The measurement of flounder antibody by ELISA was made possible by successively making a rabbit antibody and an enzyme tagged goat antibody react to the flounder antibody. By ELISA, the antibodies were able to be measured with a sensitivity 5 to 6 times higher compared with the conventional agglutination. The vaccination was prepared experimentally by producing edwardsiella tarda in aquaculture, adding formalin to inactivate it, and cleaning it with a physiological salt water. The vaccination thus prepared was administered to 4 groups of flounder consisting of those weighing 3, 17, 146 and 516g by means of injection or immersion. After that, the measurement was taken of antibody titers by ELISA, and a challenge test was performed by injecting edwardsiella tarda. A rise in antibody titers was observed in all sizes under the injection and in a part of the 516g group of flounders under the immersion. The effect of the administration was such that the increase in protective immunity was recognized under the injection but not under the immersion. 33 refs., 11 figs., 1 tab.

24711 (CRIE-U–94020) **Literature survey on fish disease treatments in mari-culture systems (state-of-the-art and future subjects).** Kiyono, M. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Furuta, T.; Shinshima, K.; Ishikawa, Y. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Aut 1994. 29p. (In Japanese). Order Number DE95790554. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

A data base system was formed concerning literatures on fish disease treatments. Comprehension for the present situation was also made on measures against fish disease based on these literal information, and the future directions were studied. Approximately 300 compilations (220 domestic and 80 overseas) of literatures were selected concerning the preventive measures and diagnostic techniques of fish disease that were made public in and after 1980; and the literature data base system (named FISHDIS) was formed by means of personal computers. This literature data base system enables extraction of required literature by key words and bibliographies, and it is capable of outputting a summary card describing the main points of information that is useful for the prevention or diagnosis. Medicines are mainly used for the treatments of bacterial fish disease and for the prevention of contagion. It is desirable to minimize the use of medicines, and development is in progress in the technique of early detection/diagnosis and disease prevention methods such as vaccination instead of using medicines. It is scheduled to further promote the development of disease prevention technology such as vaccination from now on. 49 refs., 2 figs., 2 tabs.

24712 **Detecting small holes in packages.** Kronberg, J.W.; Cadieux, J.R. To Dept. of Energy. 1993. Filed date 2 Jun 1993. U.S. Patent Application 8-070,196. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE95015037. Source: OSTI; NTIS (US Sales Only); GPO Dep.

According to its major aspects and broadly stated, the present invention is a package with a product and tracer gas inside that lends itself to leak testing and a method for detecting the presence of a hole in a package. The tracer gas is preferably sulfur hexafluoride (SF_6), although other, nontoxic perfluorinated gases such as carbon tetrafluoride (CF_4) may also be used. A quantity of the tracer gas is put into the package along with the product and the package is closed. The concentration of the tracer gas in the atmosphere outside the package is then measured and compared to a predetermined value. A measured concentration greater than the predetermined value indicates that the packaging material may have a small hole in it. To ensure the safety of their products, food processors are required by law to assess the integrity of the packages they distribute. Ideally, all packages are inspected at-least visually. However, routine inspection of all packages is time-consuming and expensive, so testing is usually carried out on sample packages removed from the production line. Sampling offers a method for assessing the overall quality of the packages, but

cannot indicate which of the packages actually distributed by the manufacturer are defective.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 23196, 23298, 23355, 23362, 23590, 24352, 24587, 24605, 24710, 24711, 24731, 24738, 24899

24713 (ANL/EQO/SUMM–85950) **Issues in environmental control data used in DD&ER worker dose exposures.** White, M.G. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9509156–1: Annual meeting of the Society for Applied Spectroscopy, Philadelphia, PA (United States), 17-21 Sep 1995). Order Number DE95013516. Source: OSTI; NTIS; INIS; GPO Dep.

Sites for decontamination and decommissioning (DD) or environmental remediation (ER) are often from US DOE operations that began during and shortly after World War II. This paper discusses selected problems in the use of environmental data for DD and ER worker dose exposure calculations.

24714 (CONF-9304293–) **Fourth International Conference on Anticarcinogenesis and Radiation Protection: Supplement. Volume 54, No. 7.** Johns Hopkins Univ., Baltimore, MD (United States). 1 Apr 1994. 191p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-93ER61574. From 4. international conference on anticarcinogenesis and radiation protection; Baltimore, MD (United States); 18 Apr 1993 - 23 apr 1995. Order Number DE95009802. Source: OSTI; NTIS; GPO Dep.

This volume contains full papers of presentations given at the 4th International Conference of Anticarcinogenesis and Radiation Protection held in Baltimore, Maryland April 18–23, 1993. Presentations were grouped into topic areas entitled Mechanisms of Cancer and Aging; Biomarkers and Susceptibility Factors; Molecular Diagnosis; Nutrition, exercise, and Cancer; Molecular Mechanisms of Chemoprotection; and Clinical Interventions.

24715 (CONF-950430–6) **Geo-coding of health and demographic data as a resource for environmental incidents preparedness and response.** Lackland, D.T.; Dunbar, J.B.; Jones, R.M. Medical Univ. of South Carolina, Charleston, SC (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-92EW50625. From 5. ANS topical meeting on emergency preparedness and response; Savannah, GA (United States); 18-21 Apr 1995. Order Number DE95013876. Source: OSTI; NTIS; GPO Dep.

Short communication. HEALTH HAZARDS/monitoring; PUBLIC HEALTH/monitoring; EMERGENCY PLANS; COMPLEX TERRAIN; POPULATION DENSITY; MONITORING; COMPUTER CALCULATIONS; GEOGRAPHICAL VARIATIONS

24716 (DOE/CH/10330–T1) **Genetic effects of plutonium in Drosophila. Final technical report.** Alabama A and M Univ., Normal, AL (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87CH10330. Order Number DE95014926. Source: OSTI; NTIS; GPO Dep.

This three year project, initiated in 1987, involved the genetic effects of alpha radiations on Drosophila. This document represents the final technical report. Plutonium residue was used as the alpha source of radon gas. Spontaneous mutation frequency in the Drosophila stock was very low. In the experiments using alpha radiation from radon gas, radiation doses as low as 20R induced significant numbers of mutations, with higher numbers of mutations at higher doses. If X-ray induced mutation frequencies reported in the literature are used for comparison, it can be concluded that alpha radiation from radon gas induces at least 2 to 3 time more mutations in Drosophila.

24717 (DOE/ER/60455–8) **Mechanisms for radiation damage in DNA. Progress report, June 1, 1994–May 31, 1995.** Sevilla, M.D. Oakland Univ., Rochester, MI (United States). Nov 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER60455. Order Number DE95014982. Source: OSTI; NTIS; INIS; GPO Dep.

In this project we have proposed several mechanisms for radiation damage to DNA and its constituents, and have detailed a series of experiments utilizing electron spin resonance spectroscopy, HPLC, GC-mass spectroscopy and ab initio molecular orbital calculations to test the proposed mechanisms. The results from these various techniques have resulted in an understanding of consequences of radiation damage to DNA from the early ionization event to the production of non-radical lesions (discussed in detail in Comprehensive Report). In this year's work we have found the hydroxyl radical in DNA's hydration layer. This is an important result which impacts the hole transfer hypothesis and the understanding of the direct vs. indirect effect in DNA. Further we have found the first ESR evidence for sugar radicals as a result of direct radiation damage to DNA nucleotides in an aqueous environment. This is significant as it impacts the biological endpoint of radiation damage to DNA and suggests future work in DNA. Work with DNA-polypeptides show clear evidence for electron transfer to DNA from the polypeptide which we believe is a radioprotective mechanism. Our work with ab initio molecular orbital theory has gain insight into the initial events of radiation damage to DNA. Ab initio calculations have provided an understanding of the energetics involved in anion and cation formation, ion radical transfer in DNA as well as proton transfer with DNA base pair radical ions. This has been extended in this year's work to new, more accurate values for the electron affinities of the DNA bases, understanding of the relative stability of all possible sugar radicals formed by hydrogen abstraction on the deoxyribose group, hydration effects on, thiol radioprotectors, and an ongoing study of radical intermediates formed from initial DNA ion radicals. During this fiscal year five articles have been published, three are in press, two are submitted and several more are in preparation.

24718 (DOE/ER/60455–9) **Mechanisms for radiation damadge in DNA.** Sevilla, M.D. Oakland Univ., Rochester, MI (United States). Nov 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER60455. Order Number DE95014699. Source: OSTI; NTIS; INIS; GPO Dep.

A comprehensive report is provided of the author's research since 1986 on radiolysis of DNA as well as current state of knowledge in this area. In particular study areas such as the influence of hydration on the absolute yield of primary ionic free radicals in irradiated DNA at 77K, Ab Initio molecular orbital calculations of DNA base pairs and their radical ions, and radiation-induced DNA damage as a function of hydration are discussed.

24719 (ENEA-RT-AMB–94-02) **X and gamma rays irradiation tests for evaluating performances of Italian dosimetry services.** Cavallini, A. (ENEA, Bologna (Italy). Area Energia Ambienete e Salute); Kaftal, S.; Klamert, V. ENEA, Bologna (Italy). Area Energia Ambienete e Salute. May 1994. 14p. Order Number DE95789728. Source: OSTI; NTIS (US Sales Only).

The ENEA (Italian Agency for New Technologies, Energy and the Environment)-EDP Group (Personal Dosimetry Experts) has already evaluated the reliability of more than 50% of the 70 Italian personal dosimetry services, which agreed to test their dosimeters through X and gamma irradiation in air. Film,TL and both film and TL are used as detectors. The X and gamma rays energy ranges from 30 keV to 1.250 keV (beam defined by ISO 4037). Exposures range from 5.2 10^{-6} C/kg to 1.3 10^{-3} C/kg. Some dosimeters have been irradiated with a single energy level and others with two energy levels. For each one of the nearly 4.000 dosimeters already tested, the ratio R has been calculated: $R = X_v/X_a$ where: X_v is the exposure evaluated by the service, X_a is the actual exposure. The R distributions have been analysed for the dosimeters using film or TL as detectors, as a function of irradiation energy and as a function of exposure values. The results obtained by all tested services are commented. Separate comments deal also with possible reasons of the failures to pass the tests.

24720 (GSF–4/95) **Risk and probability of causation of extrapulmonary cancers due to the occupational radiation exposure of workers at the previous WISMUT Uranium Mining**

Company. Jacobi, W.; Roth, P. GSF - Forschungszentrum fuer Umwelt und Gesundheit Neuherberg GmbH, Oberschleissheim (Germany). Inst. fuer Strahlenschutz. Mar 1995. 86p. (In German). Sponsored by Hauptverband der Gewerblichen Berufsgenossenschaften e.V., St. Augustin (Germany). Order Number DE95795657. Source: OSTI; NTIS (US Sales Only); INIS.

For the evaluation of the lung cancer risk from inhaled radon progeny direct epidemiological data from other groups of uranium miners are available. These data yield, however, no quantitative evidence for extrapulmonary cancers. Therefore, in this study an indirect dosimetric approach for the evaluation of the possible excess relative risk (ERR) of extrapulmonary cancers among the WISMUT workers was applied. In this approach the following exposure pathways are taken into account: (1) The inhalation of radon and its short-lived progeny; (2) the inhalation of uranium (U-238, U-235) and its decay products with the ore dust; and (3) the tissue doses from external γ and β radiation. Tissue doses from inhaled radionuclides were calculated applying the new respiratory tract model recommended in ICRP Publication 68 (1994). The evaluation of the attributed ERR proceeds from the recently published data of the Life Span Study on the excess cancer incidence in the atomic bomb survivors, taking into account a DDREF of 2 and a radiation weighting factor of 20 for alpha radiation. For solid cancers a time-constant relative risk model was used, whereas for leukemias, lyphomas and myelomas the variation of the ERR with time since exposure was taken into regard. Central best estimates of the resulting ERR and the attributed probability of causation of extrapulmonary cancers are given for typical exposure conditions of the WISMUT uranium miners, particularly for the critical years 1946-55. For most extrapulmonary cancer types the ERR values are more than a factor of 10 lower than the corresponding value for lung or bronchial cancer, respectively. The only exemption concerns cancers in the extrathoracic region (Mouth region, pharynx and larynx) for which the ERR is only about a factor of 5 lower than the ERR for lung cancer. Finally, general conclusions and recommendations for the decision making in the individual acknowledgement procedure are outlined. (orig./HP)

24721 (JAERI-Data/Code–95-002) **Attenuation coefficients of human tissues and tissue substitutes.** Shirotani, Takashi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 63p. (In Japanese). Order Number DE95789319. Source: OSTI; NTIS; INIS.

Development of realistic torso phantom for the calibration of Pu chest counting system was completed in 1987. In order to manufacture the phantom, many human tissue substitutes (tissue equivalent materials) were newly developed. For the development, firstly, attenuation coefficients for 8 keV - 1 MeV photons were calculated for human tissues and organs listed in ICRP Reference Man document. Attenuation coefficients of the produced soft tissue substitutes (SZ-series) and bone substitutes (EZ-series) were also calculated in the same energy range. Moreover, for comparison, the calculations of attenuation coefficients for the existing plastics used as phantom materials, ICRU spherical phantom, Griffith phantom and others were carried out in the same way. In this report, the calculated mass and linear attenuation coefficients of these materials, and human tissues and organs are compiled. (author).

24722 (LA–12981-MS) **Table of DOE-STD-1027-92 Hazard Category 3 threshold quantities for the ICRP-30 list of 757 radionuclides: LANL fact sheet.** Clow, J.; Elder, J.; Heindel, G.; Inkret, W.; Miller, G. Los Alamos National Lab., NM (United States). Aug 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95016704. Source: OSTI; NTIS; INIS; GPO Dep.

A table of DOE-STD-1027-92 Hazard Category 3 threshold quantities, in units of curies and grams, is presented for the International Commission on Radiological Protection-30 (ICRP-30) list of 757 radionuclides. The specific activity (Ci/gm) used to convert the threshold quantities from curies to grams is also calculated and tabulated. The half-life values used to generate the specific activities are those specified in ICRP-30.

24723 (LNF-IR–95-017) **New methodologies of biological dosimetry applied to human protection.** Catena, C. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Parasacchi, P.; Conti, D.; Righi, E. Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Apr 1995. 74p. (In Italian). Order Number DE95789748. Source: OSTI; NTIS (US Sales Only).

Biological dosimetry is a diagnostic methodology for the measurement of the individual dose absorbed in the case of accidental overexposition to ionizing radiation. It is demonstrated how in vitro radiobiological and chemobiological studies using cytogenetic methods (count of chromosomal aberrations and micronuclei) on human lymphocytes from healthy subjects and individuals undergoing radiotherapy or chemotherapy, as well as on lymphocytes of mammals other than man (comparative cytogenetics), can help to increase the basic radiobiological and chemobiological scientific information. Such information gives a valid contribution to understanding of the action of ionizing radiation or of pharmaceuticals on cells and, in return, can be of value to human radioprotection and chemoprotection. Cytogenetic studies can be summerized as follows: (a) biodosimetry (estimate of dose received after accidental events); (b) individual radiosensitivity (level of individual response); (c) clinical radiobiology and chemobiology (individual response to radiopharmaceuticals, to radiotherapy and to chemopharmaceuticals); (d) comparative radiobiology (cytogenetic studies on species other than man); (e) animal model in the environmental surveillance.

24724 (ORISE–94/G-34) **Adjusting external doses from the ORNL and Y-12 facilities for the Oak Ridge Nuclear Facilities mortality study.** Watkins, J.P. (Oak Ridge Inst. for Science and Education, TN (United States)); Cragle, D.L.; West, C.M.; Tankersley, W.G.; Frome, E.L.; Crawford-Brown, D.J. Oak Ridge Inst. for Science and Education, TN (United States). [1995]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE95013844. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents specific procedures used for adjusting radiation doses to radiation personnel at the ORNL and Y-12 plants during the early years. Topics discussed include: background information; selection of employment years to be considered; hardcopy monitoring methods and records; pocket meter data; and replacement of 1943 unmonitored employment years. These topics were discussed for both years.

24725 (ORISE–95/B-22) **Oak Ridge Institute for Science and Education, Medical Sciences Division report for 1994.** Snyder, F.; Poston, S.; Engle, J. (eds.). Oak Ridge Inst. for Science and Education, TN (United States). Medical Sciences Div. [1995]. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE95015624. Source: OSTI; NTIS; INIS; GPO Dep.

The primary mission of the Medical Sciences Division is (1) to conduct basic and applied biomedical research on human health related to energy systems, (2) to provide technical assistance and training in occupational and environmental medicine, and (3) to make related biomedical applications available to others through technology transfer. As can be gleaned from this report, the strengths and capabilities of their staff in carrying out this mission are closely aligned with the four core competencies of ORISE: (1) occupational and environmental health, (2) environmental and safety evaluation and analysis, (3) education and training, and (4) enabling research. Brief descriptions of the various scientific and technical programs and their progress, as well as the staff responsible for the accomplishments made during 1994, are presented in this report. Research programs include the following: biochemistry; cytogenetics; Center for Epidemiologic Research; Center for Human Reliability Studies; occupational medicine; Radiation Emergency Assistance Center/Training Site; and Radiation Internal Dose Information Center.

24726 (PNL–10614) **Hanford radiological protection support services annual report for 1994.** Lyon, M.; Bihl, D.E.; Fix, J.J.; Piper, R.K.; Froelich, T.J.; Olsen, P.C. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015592. Source: OSTI; NTIS; GPO Dep.

Various Hanford Site radiation protection services provided by the Pacific Northwest Laboratory for the US Department of Energy Richland Operations Office and Hanford contractors are described in this annual report for the calendar year 1994. These activities include external dosimetry measurements and evaluations, internal dosimetry measurements and evaluations, in vivo measurements, radiological record keeping, radiation source calibration, and instrument calibration and evaluation. For each of these activities, the routine program and any program changes or enhancements are described, as well as associated tasks, investigations, and studies. Program- related publications, presentations, and other staff professional activities are also described.

24727 (PNL-SA–26269) **Radical production in biological systems.** Johnson, J.R.; Akabani, G. Pacific Northwest Lab., Richland, WA (United States). Oct 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9410280–2: International workshop on radiation damage in DNA: relationships at early times, Gleneden, OR (United States), 1-6 Oct 1994). Order Number DE95014172. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes our effort to develop a metric for radiation exposure that is more fundamental than adsorbed dose and upon which a metric for exposure to chemicals could be based. This metric is based on the production of radicals by the two agents. Radicals produced by radiation in biological systems commonly assumed to be the same as those produced in water despite the presence of a variety of complex molecules. This may explain why the extensive efforts to describe the relationship between energy deposition (track structure) and molecular damage to DNA, based on the spectrum of radicals produced, have not been successful in explaining simple biological effects such as cell killing. Current models assume that DNA and its basic elements are immersed in water-like media and only model the production and diffusion of water-based radicals and their interaction with DNA structures; these models lack the cross sections associated with each macrocomponent of DNA and only treat water-based radicals. It has been found that such models are not realistic because DNA is not immersed in pure water. A computer code capable of simulating electron tracks, low-energy electrons, energy deposition in small molecules, and radical production and diffusion in water like media has been developed. This code is still in at a primitive stage and development is continuing. It is being used to study radical production by radiation, and radical diffusion and interactions in simple molecular systems following their production. We are extending the code to radical production by chemicals to complement our PBPK modeling efforts. It therefore has been developed primarily for use with radionuclides that are in biological materials, and not for radiation fields.

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 23337, 23341, 23499, 24563, 24624

24728 (DOE/ER/61666–2) **Changes in the flux of carbon between plants and soil microorganisms at elevated CO_2: Physiological processes with ecosystem-level implications. Progress report, [August 15, 1994–August 14, 1995].** Zak, D.R. (Michigan Univ., Ann Arbor, MI (United States). School of Natural Resources and Environment); Pregitzer, K.S. Michigan Univ., Ann Arbor, MI (United States). School of Natural Resources and Environment. 15 May 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-93ER61666. Order Number DE95015511. Source: OSTI; NTIS; GPO Dep.

This report presents the details of a research program that investigated the impacts of elevated carbon dioxide on terrestrial ecosystems. This report focused on the effects of plant carbon allocation, microbial activity, soil changes, and nitrogen dynamics.

24729 (DOE/EW/50625–T22) **Environmental Hazards Assessment Program quarterly report, January–March 1995.** Medical Univ. of South Carolina, Charleston, SC (United States). 30 Apr 1995. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-92EW50625. Order Number DE95012199. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of the Environmental Hazards Assessment Program (EHAP) stated in the proposal to DOE are to: develop a holistic, national basis for risk assessment, risk management, and risk communication that recognizes the direct impact of environmental hazards on the health and well-being of all; develop a pool of talented scientists and experts in cleanup activities, especially in human health aspects; and identify needs and develop programs addressing the critical shortage of well-educated, highly-skilled technical and scientific personnel to address the health oriented aspects of environmental restoration and waste management. This report describes activities and reports on progress for the third quarter (January–March) of the third year of the grant. It reports progress against these grant objectives and the Program Implementation Plan published at the end of the first year of the grant. Questions, comments, or requests for further information concerning the activities under this grant can be forwarded to Jack Davis in the EHAP office of the Medical University of South Carolina at (803) 727-6450.

24730 (DOE/EW/50625–T23) **Environmental hazards assessment program. Annual report, July 1, 1994–June 30, 1995.** Medical Univ. of South Carolina, Charleston, SC (United States). 31 Jul 1995. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-92EW50625. Order Number DE95016210. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes activities and reports on progress for the third year of the DOE grant to support the Environmental Hazards Assessment Program (EHAP). It reports progress against grant objectives and the Program Implementation Plan published at the end of the first year of the grant. As the program has evolved, more projects have been funded and many existing projects have become more complex. Thus, to accomplish better the objectives over the years and retain a solid focus on the total mission, we have reorganized the grant effort from three to five majoe elements: Public and professional outreach; Clinical programs; Science programs; Information systems; and, Program management.

24731 (DOE/EW/50625–T24) **Environmental Hazards Assessment Program. Quarterly report, April–June 1995.** Medical Univ. of South Carolina, Charleston, SC (United States). 31 Jul 1995. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-92EW50625. Order Number DE95016211. Source: OSTI; NTIS; GPO Dep.

The objectives of this report are to: (1) develop a holistic, national basis for risk assessment, risk management, and risk communication that recognizes the direct impact of environmental hazards, both chemical and radiation, on the health and well-being of all; (2) develop a pool of talented scientists and experts in cleanup activities, especially in human health aspects; and (3) identify needs and develop programs addressing the critical shortage of well-educated, highly-skilled technical and scientific personnel to address the health oriented aspects of environmental restoration and waste management. This report describes the progress made this quarter in the following areas: public and professional outreach; science programs; clinical programs; and information support and access systems.

24732 (ENEA-RT-AMB–94-08) **Carbonaceous particles as carrier of toxicants in body.** Pagano, P. (ENEA, Bologna (Italy). Area Energia Ambiente e Salute); Bruni, S. ENEA, Bologna (Italy). Area Energia Ambiente e Salute. Jun 1994. 41p. (In Italian). Order Number DE95789711. Source: OSTI; NTIS (US Sales Only).

Gas and airborne particles interact in the atmosphere, especially in urban and highly industrialized areas, where combustion processes produce complex mixtures of chemicals including a great deal of carbonaceous particles. These carbonaceous particles catalyze and adsorb airborne substances that modify their biological disposition in the breathing body. The aim of this review is to collect the state of knowledge in the international field, on the role of carbonaceous particles as a carrier of chemicals in the body. This study is worked out in the Pluriannual Program of Inhalation Toxicology (INTO) of ENEA (Italian Agency for Energy, New Technologies and the Environment) to study the occurrence of early indicators of pulmonary diseases induced by inhalation of urban air pollutants.

24733 (ETDE-DE–146) **Application of selected biomonitoring plants in the scope of practical air pollution control. Pt. 1. Transfer of the results of exposure experiments with bioindicator plants to the local vegetation.** Sommer, B.; Kostka-Rick, R. Technischer Ueberwachungs-Verein Stuttgart e.V., Filderstadt (Germany). Fachabteilung Umweltwirkungen. Dec 1992. 332p. (In German). Sponsored by Umweltbundesamt, Berlin (Germany). Contract UFOPLAN 10802078. (UBA-FB–93-077/1). Order Number DE95791347. Source: OSTI; NTIS (US Sales Only).

The objective of this study is to enhance the applicability and acceptance of the use of response measurements, particularly that of active biomonitoring emploing the standardized grass exposure method. This was achieved by compiling a procedure for interpretation of results and deriving conclusions for measures to be taken in pursuit of specified goals, e.g. human or livestock health. One important consideration of this study is the transferability of results from active biomonitoring using the grass exposure method to the vegetation growing at the same location. The investigations were conducted by the TUeV Suedwest in two networks related to specified emission sources, where pollutant-responses are assessed routinely for the elements fluorine, lead and cadmium. Transfer factors based on threshold values are proposed for the elements fluorine and lead to relate results from the grass exposure method to pasture, grass, dandelion, red clover and white clover. Also, recommendations are derived for protecting grazing livestock and man as the final link in the food chain. The paper also presents transfer factors to relate the results from the standardized exposure of lettuce to field-grown lettuce and parsley. (orig.)

24734 (ETDE-DE–147) **Application of selected biomonitoring plants in the scope of practical air pollution control. Pt. 2. Development of an evaluation and assessment procedure on the basis of pollution effect measurements carried out in the Esslingen/Altbach region since 1983.** Franz-Gerstein, C.; Maier-Reiter, W.; Sommer, B. Technischer Ueberwachungs-Verein Stuttgart e.V., Filderstadt (Germany). Fachabteilung Umweltwirkungen. Dec 1992. 86p. (In German). Sponsored by Umweltbundesamt, Berlin (Germany). Contract UFOPLAN 10802078. (UBA-FB–93-077/2). Order Number DE95791346. Source: OSTI; NTIS (US Sales Only).

To date there is little coordination in the communication of data collected and compiled in the scope of practical air pollution control, each study being presented and interpreted separately and independently. This report presents a procedure to jointly evaluate and interpret such information. This procedure is illustrated using results from exposure-response studies, where results from different monitoring levels are compiled and compared. The major objective of this procedure is to provide a presentation and interpretation of results that differentiate with respect to the various criteria of protection. A brief introduction into biomonitoring methods and the legislative and formal basis of such investigations is given long with the presentation and discussion of this procedure. (orig.)

24735 (ETDE-DE–171) **Root growth and pH values in the rhizosphere of spruce as a function of acid sprinkle irrigation and liming. Final report.** Hahn, G. Hohenheim Univ., Stuttgart (Germany). Inst. fuer Pflanzenernaehrung. Feb 1994. 99p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 0339175J. Order Number DE95796015. Source: OSTI; NTIS (US Sales Only).

The present study was executed as part of the "Hoeglwald" research project. The Hoeglwald near Augsburg is made up of healthy, stately spruce past 80 years of age. The soil is a podsolic Grey forest soiltype (pH4) with a mold cover. A study was made of the effects of different kinds of treatment, i.e. acid and neutral sprinkle irrigation and liming, on root growth and distribution, nutritive state, and soil pH in and outside the rhizosphere. The methods used were mostly nondestructive (root windows, pH microelectrodes, agar techniques). These were complemented by destructive methods, viz. soil cores, ingrowth cores, and chemical root analyses. A rhizotron was used for studying aluminium complexing in the rhizosphere of long roots by means of a combination of the aluminon method and agar techniques and for determining the content in organic acids of root exudate by means of HPLC. The results obtained permit the following conclusions. Acid sprinkle irrigation inhibits root growth in spruce whereas liming over the long term neutralises the effects of acid sprinkle irrigation on root growth. Average soil pH and aluminium concentration bear little information regarding root growth in spruce. Soil-chemical conditions in the rhizosphere are more specific determinants of root growth. The molar Ca/Al ratios used until now for assessing aluminium toxicity in spruce must be modified for field research. (orig.)

24736 (LA–12971-SR) **Aquatic macroinvertebrates and water quality of Sandia Canyon, Los Alamos National Laboratory, November 1993–October 1994.** Cross, S. Los Alamos National Lab., NM (United States). Aug 1995. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015054. Source: OSTI; NTIS; GPO Dep.

The Ecological Studies Team (EST) of ESH-20 at Los Alamos National Laboratory (LANL) has collected samples from the stream within Sandia Canyon since the summer of 1990. These field studies gather water quality measurements and collect aquatic macroinvertebrates from permanent sampling sites. Reports by Bennett (1994) and Cross (1994) discuss previous EST aquatic studies in Sandia Canyon. This report updates and expands those findings. EST collected water quality data and aquatic macroinvertebrates at five permanent stations within the canyon from November 1993 through October 1994. The two upstream stations are located below outfalls that discharge industrial and sanitary waste effluent into the stream, thereby maintaining year-round flow. Some water quality parameters are different at the first three stations from those expected of natural streams in the area, indicating degraded water quality due to effluent discharges. The aquatic habitat at the upper stations has also been degraded by sedimentation and channelization. The macroinvertebrate communities at these stations are characterized by low diversities and unstable communities. In contrast, the two downstream stations appear to be in a zone of recovery, where water quality parameters more closely resemble those found in natural streams of the area. The two lower stations have increased macroinvertebrate diversity and stable communities, further indications of downstream water quality improvement.

24737 (SREL–49) **STResS (Simulated Toxicant-Related Stress) documentation.** Greene, K.D.; Newman, M.C.; Jagoe, R.H. Savannah River Ecology Lab., Aiken, SC (United States). [1994]. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00819. Order Number DE95015348. Source: OSTI; NTIS; GPO Dep.

STResS (Simulated Toxicant-Related Stress) is a program written in DEC FORTRAN v. 6.2. This program can be run either interactively or batch mode. This program is designed to model the effects of toxicant exposure on a simulated population of a specific species, as well as the effects of the toxicant on the demographic and genetic characteristics. The toxic effect on the time-to-death is based on an accelerated failure time model in which the time-to-death depends on size, sex and genotype, toxicant concentration, and frequency and duration of exposure. Sexual, fecundity, and meiotic drive/gametic selection can also be included. Multiple simulations can be run for a user-specified number of gestation periods of user-specified length. The effect of winter can be included, and the exposure duration can be changed once during each simulation, if desired.

24738 (WHC-SA–2818) **The societal impact value of risk.** Simpson, D.E. Westinghouse Hanford Co., Richland, WA (United States). Apr 1995. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012572. Source: OSTI; NTIS; INIS; GPO Dep.

A key ill-defined issue in the management and regulation of potentially hazardous conditions is that of the value to be associated with a reduction (or existence) of human health risks, such as radiation exposure or hazardous substance ingestion. Empirical observations of societal behavior patterns lead to a relationship for the quantitative value of societal risk impact which is consistent with general societal risk acceptance, is not inconsistent with "de facto" risk regulation, and is suitable and appropriate as a specification or guide for risk management and risk regulation. This societal risk

impact expression is: Impact ($/year) = ($8 \times 10^7$) $NR_i^{4/3}$ where Ri = individual annual mortality risk; N = number of persons in the population sharing the risk and benefits. The change in impact which can be derived from a regulation or risk management activity is the value of annual benefit which society would expect to forego (or annual equivalent cost to incur) in consideration of the activity.

5604 Other Environmental Pollutant Effects

Refer also to citation(s) 23455, 23494, 23505

24739 (DOE/ER/61789–1) **BEMS: Abstract book.** Building Services Research and Information Association, Bracknell (United Kingdom). Building Energy Management Systems (BEMS) Centre. [1995]. 176p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-94ER61789. (CONF-9506193–Absts.: 16. Bioelectromagnetics Society (BEMS) annual meeting, Copenhagen (Denmark), 12-17 Jun 1995). Order Number DE95013088. Source: OSTI; NTIS; GPO Dep.

This volume provides abstracts of presentations made at the Sixteenth Meeting of The Bioelectromagnetics Society held June 12-17, 1994 in Copenhagen, Denmark.

57 HEALTH AND SAFETY

Refer also to citation(s) 23399, 24931, 24934, 25007

24740 (SAND–95-0347C) **Passive safety concepts applied to critical functions.** Spray, S.D.; Cooper, J.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950740–67: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95007738. Source: OSTI; NTIS; GPO Dep.

Safety is of paramount concern in todays high technology environment. Because of technological advances, there are numerous situations (high consequence operations) for which the implications of a safety failure are so severe that extreme attention to safety systems is essential. Some of those situations are: nuclear weapon detonation safety, nuclear reactor safety, dam safety, mass transit transportation safety, and hazardous materials transportation and handling safety. In each case, specific safety systems, human control, and administrative procedures have been designed to give a high level of assurance against disasters. In an overview sense, safety concepts can be divided into two broad approaches: active safety and passive safety. Active safety systems, in general, are based on the need for "functioning" elements (operating motors, operator action, etc.) and safety may be based in a large measure on "reliability" data (historical records of the operability success of components). Passive safety basically depends on non-functionality.

58 GEOSCIENCES

Refer also to citation(s) 23050, 23051, 23052, 23053, 23060, 23061, 23065, 23172, 23173, 23188, 23210, 23213, 23214, 23238, 23239, 23253, 23316, 23332, 23495, 23659, 23937, 24404, 24447, 24582, 24583, 24594

24741 (ANL/RE/CP–85743) **Application of neural networks to seismic active control.** Tang, Yu. Argonne National Lab., IL (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950740–59: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95014238. Source: OSTI; NTIS; INIS; GPO Dep.

An exploratory study on seismic active control using an artificial neural network (ANN) is presented in which a singledegree-of-freedom (SDF) structural system is controlled by a trained neural network. A feed-forward neural network and the backpropagation training method are used in the study. In backpropagation training, the learning rate is determined by ensuring the decrease of the error function at each training cycle. The training patterns for the neural net are generated randomly. Then, the trained ANN is used to compute the control force according to the control algorithm. The control strategy proposed herein is to apply the control force at every time step to destroy the build-up of the system response. The ground motions considered in the simulations are the N21E and N69W components of the Lake Hughes No. 12 record that occurred in the San Fernando Valley in California on February 9, 1971. Significant reduction of the structural response by one order of magnitude is observed. Also, it is shown that the proposed control strategy has the ability to reduce the peak that occurs during the first few cycles of the time history. These promising results assert the potential of applying ANNs to active structural control under seismic loads.

24742 (ANL/RE/CP–86338) **Seismic evaluation methods for existing buildings.** Hsieh, B.J. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950740–56: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95014247. Source: OSTI; NTIS; GPO Dep.

Recent US Department of Energy natural phenomena hazards mitigation directives require the earthquake reassessment of existing hazardous facilities and general use structures. This applies also to structures located in accordance with the Uniform Building Code in Seismic Zone 0 where usually no consideration is given to seismic design, but where DOE specifies seismic hazard levels. An economical approach for performing such a seismic evaluation, which relies heavily on the use of preexistent structural analysis results is outlined below. Specifically, three different methods are used to estimate the seismic capacity of a building, which is a unit of a building complex located on a site considered low risk to earthquakes. For structures originally not seismically designed, which may not have or be able to prove sufficient capacity to meet new arbitrarily high seismic design requirement and which are located on low-seismicity sites, it may be very cost effective to perform detailed site-specific seismic hazard studies in order to establish the true seismic threat. This is particularly beneficial, to sites with many buildings and facilities to be seismically evaluated.

24743 (BNL–61710) **Fractal dynamics of earthquakes.** Bak, P. (Brookhaven National Lab., Upton, NY (United States). Dept. of Physics); Chen, K. Brookhaven National Lab., Upton, NY (United States). 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95011783. Source: OSTI; NTIS; GPO Dep.

Many objects in nature, from mountain landscapes to electrical breakdown and turbulence, have a self-similar fractal spatial structure. It seems obvious that to understand the origin of self-similar structures, one must understand the nature of the dynamical processes that created them: temporal and spatial properties must necessarily be completely interwoven. This is particularly true for earthquakes, which have a variety of fractal aspects. The distribution of energy released during earthquakes is given by the Gutenberg-Richter power law. The distribution of epicenters appears to be fractal with dimension $D \approx 1–1.3$. The number of after shocks decay as a function of time according to the Omori power law. There have been several attempts to explain the Gutenberg-Richter law by starting from a fractal distribution of faults or stresses. But this is a hen-and-egg approach: to explain the Gutenberg-Richter law, one assumes the existence of another power-law–the fractal distribution. The authors present results of a simple stick slip model of earthquakes, which evolves to a self-organized critical state. Emphasis is on demonstrating that empirical power laws for earthquakes indicate that the Earth's crust is at the critical state, with no typical time, space, or energy scale. Of course the model is tremendously oversimplified; however in analogy with equilibrium phenomena they do not expect criticality to depend on details of the model (universality).

24744 (DOE/BC/14858–2) **Board on Earth Sciences and Resources and its activities.** National Academy of Sciences, Washington, DC (United States). Jun 1995. 8p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract FG22-94BC14858. Order Number DE95016226. Source: OSTI; NTIS; GPO Dep.

The Board on Earth Sciences and Resources (BESR) coordinates, the National Research Council's advice to the federal government on solid-earth science issues. The board identifies opportunities for advancing basic research and understanding, reports on applications of earth sciences in such areas as disaster mitigation and resource utilization, and analyzes the scientific underpinnings and credibility of earth science information for resource, environmental and other applications and policy decision. Committees operating under the guidance of the Board conducts studies addressing specific issues within the earth sciences. The current committees are as follows: Committee on Geophysical and Environmental Data; Mapping Sciences Committee; Committee on Seismology; Committee on Geodesy; Rediscovering Geography Committee; Committee on Research Programs of the US Bureau of Mines. The following recent reports are briefly described: research programs of the US Bureau of Mines, first assessment 1994; Mount Rainier, active cascade volcano; the national geomagnetic initiative; reservoir class field demonstration program; solid-earth sciences and society; data foundation for the national spatial infrastructure; promoting the national spatial data infrastructure through partnerships; toward a coordinated spatial data infrastructure for the nation; and charting a course into the digital era; guidance to the NOAA's nautical charting mission.

24745 (DOE/BC/14883–T2) **National Geoscience Data Repository System: Phase 2, Planning and pilot study. Progress report, February–April 1995.** Illinois Inst. of Tech., Chicago, IL (United States). May 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92BC14883. Order Number DE95014915. Source: OSTI; NTIS; GPO Dep.

The American Geological Institute (AGI) recently completed the first phase of a multiphase program to study and implement a National Geoscience Data Repository System (NGDRS) to capture and preserve valuable geoscientific data. They study was initiated in response to the fact that tens of billions of dollars worth of domestic eological and geophysical data are in jeopardy of being irrevocably lost or destroyed as a consequence of the ongoing downsizing of the US energy and minerals industry. The NGDRS would serve as an important and valuable source of information for the entire geoscience community for a variety of applications, including environmental protection, water resource management, global change studies, reducing risks from earthquakes and other geologic hazards, and basic and applied research. The repository system would also contain critical data that would enable domestic energy and minerals companies to expand their exploration and production programs in the United States for increased recovery of domestic oil, gas, and mineral resources. Progress is reported on the second phase of this program.

24746 (LA-SUB–95-59) **A specialized boundary element algorithm developed to calculate the state of stress in the Anza Gap, San Jacinto Fault Zone, Southern, CA.** Aster, R. (New Mexico Inst. of Mining and Technology, Socorro, NM (United States)); Flores, R.; Fehler, M. Los Alamos National Lab., NM (United States); New Mexico Inst. of Mining and Technology, Socorro, NM (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95012956. Source: OSTI; NTIS; GPO Dep.

The widely-used algorithm of Crouch and Starfield is unstable when used to solve our mixed boundary equation problem of interest. Altering the boundary conditions and correspondingly rearranging the system of equations to utilize double-sided boundary elements overcomes this drawback. The new algorithm described here is more physically realistic as in that it allows for rotation of the fault segments in the strain field resulting from satisfying the fault static shear strength condition. Preliminary test results indicate that a fault trifurcation gap model may describe the non-strike slip components to some of the seismicity.

24747 (LA-SUB–95-61) **Supercomputer modeling of volcanic eruption dynamics.** Kieffer, S.W. (Arizona State Univ., Tempe, AZ (United States)); Valentine, G.A.; Woo, Mahn-Ling. Los Alamos National Lab., NM (United States); Arizona State Univ., Tempe, AZ (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. LANL-Subcontract-9-XU2-U5117-1. Order Number DE95012957. Source: OSTI; NTIS; GPO Dep.

Our specific goals are to: (1) provide a set of models based on well-defined assumptions about initial and boundary conditions to constrain interpretations of observations of active volcanic eruptions–including movies of flow front velocities, satellite observations of temperature in plumes vs. time, and still photographs of the dimensions of erupting plumes and flows on Earth and other planets; (2) to examine the influence of subsurface conditions on exit plane conditions and plume characteristics, and to compare the models of subsurface fluid flow with seismic constraints where possible; (3) to relate equations-of-state for magma-gas mixtures to flow dynamics; (4) to examine, in some detail, the interaction of the flowing fluid with the conduit walls and ground topography through boundary layer theory so that field observations of erosion and deposition can be related to fluid processes; and (5) to test the applicability of existing two-phase flow codes for problems related to the generation of volcanic long-period seismic signals; (6) to extend our understanding and simulation capability to problems associated with emplacement of fragmental ejecta from large meteorite impacts.

24748 (LA-SUB–95-62) **Renewal: Continential lithosphere evolution as a function of tectonic environment.** McMillan, N.J. (New Mexico State Univ., Las Cruces, NM (United States). Dept. of Geological Sciences); Baldridge, W.S. Los Alamos National Lab., NM (United States); New Mexico State Univ., Las Cruces, NM (United States). Dept. of Geological Sciences. [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. NEW MEXICO STATE UNIVERSITY. Order Number DE95012958. Source: OSTI; NTIS; GPO Dep.

The Cenozoic tectonic environment and stress regime of the southwestern United States have changed dramatically from compression during shallow-angle subduction during the Laramide orogeny in the early Cenozoic to the current mode of Basin and Range extension. Questions remain unresolved concerning the causes of this transition, including the timing of the initiation of extension (estimates range from 36 to 25 Ma), and is the Basin and Range simply an mega-example of back-arc extension, or is extension related to the subduction of an oceanic spreading center about 30 Ma? We have examined the patterns of magmagenesis and geochemical composition through Cenozoic time in southern New Mexico. We have defined four magma sources that have contributed to Cenozoic magmas. Immediately following the Laramide, magmas contain substantial contributions from the lower crust. Mid-Tertiary extension is related to the eruption of rhyolitic ash-flow tuffs and basalts. The basalts were generated by melting of the lithospheric mantle; intercalated rhyolites have a strong upper crustal signature. Eruption of basalts and andesites with sources in the lithospheric mantle and lower crust continued for several million years after rhyolitic volcanism ceased. The region was nearly void of volcanic activity for 16 million years despite continued extension, but at 10 Ma, basalts derived from the asthenosphere began to erupt.

24749 (SAND–95-8591) **Asynchronous global optimization techniques for medium and large inversion problems.** Pereyra, V. (Weidlinger Associates, Los Altos, CA (United States)); Koshy, M.; Meza, J.C. Sandia National Labs., Livermore, CA (United States). Apr 1995. 19p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951013–1: Annual meeting of the Society of Exploration Geophysicists, Houston, TX (United States), 8-12 Oct 1995). Order Number DE95011338. Source: OSTI; NTIS; GPO Dep.

We discuss global optimization procedures adequate for seismic inversion problems. We explain how to save function evaluations (which may involve large scale ray tracing or other expensive operations) by creating a data base of information on what parts of parameter space have already been inspected. It is also shown how a correct parallel implementation using PVM speeds up the process almost linearly with respect to the number of processors,

provided that the function evaluations are expensive enough to offset the communication overhead.

24750 (UCRL-ID–119352-Pt.1) **Loch Linnhe experiment 1994: Background stratification and shear measurements. Part 1: Profile summary and dispersion relations.** Robey, H.F.; Ravizza, D.L. Lawrence Livermore National Lab., CA (United States). 10 Oct 1994. 140p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015381. Source: OSTI; NTIS; GPO Dep.

This report documents water column measurements made during the 1994 Loch Linnhe experiment, a joint US/UK radar ocean imaging experiment. Part 1 summarizes the profiles of temperature, salinity, density, Brunt-Vaisala frequency, and horizontal currents resolved into along and cross track directions. Internal wave dispersion relations, phase and group velocities, and eigenfunctions for modes 1 and 2 are computed for each profile. The effect of depth on these derived internal wave parameters is examined as well by computing eigenvalues and eigenfunctions for two different depths. The trials were conducted in Loch Linnhe, Scotland during the period from September 4, 1994 to September 17, 1994. The measurements reported herein were made from on board the R. V. Calanus, a research vessel operated by the Dunstaffnage Marine Laboratory (DML). The Calanus was moored approximately 125 meters from the track of the wake generating ship, either the R. V. Colonel Templer or a "Dog" class tug, the Collie. The depth at the mooring location was approximately 45 meters, while the depth at the closest point along the ship track was approximately 80 meters. For further details of the experiment, one is referred to the Loch Linnhe Experiment 1994: Trial Plan, Draft Version 3.0.

24751 (UCRL-ID–120121) **Hints on the use of the PCMDI Visualization and Computation System (VCS).** Williams, D.N.; Mobley, R.L.; Drach, R.S.; Phillips, T.J. Lawrence Livermore National Lab., CA (United States). Apr 1995. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014380. Source: OSTI; NTIS; GPO Dep.

This report documents the Hints interactive displays that assist a user of the PCMDI Visualization and Computation System (VCS). These Hints describe the purpose of the VCS panels and provide basic instructions on their use.

24752 (UCRL-JC–116437-Rev.1) **Lithological and rheological constraints on fault rupture scenarios for ground motion hazard prediction. Revision 1.** Foxall, W.; Hutchings, L.; Jarpe, S. Lawrence Livermore National Lab., CA (United States). Sep 1994. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409167–1-Rev.1: International Union of Theoretical and Applied Mechanics symposium on mechanics problems in geodynamics, Beijing (China), 5-9 Sep 1994). Order Number DE95013262. Source: OSTI; NTIS; GPO Dep.

This paper tests a new approach to predict a range of ground motion hazard at specific sites generated by earthquakes on specific faults. The approach utilizes geodynamics to link structural, lithological and Theological descriptions of the fault zones to development of fault rupture scenarios and computation of synthetic seismograms. Faults are placed within a regional geomechanical model that is used to calculate stress conditions along the fault. The approach is based upon three hypothesis: (1) An exact solution of the representation relation that u@s empirical. Green's functions enables very accurate computation of ground motions generated by a given rupture scenario; (2) a general description of the rupture is sufficient; and (3) the structural, lithological and Theological characteristics of a fault can be used to constrain, in advance, possible future rupture histories. Ground motion hazard here refers to three-component, full wave train descriptions of displacement, velocity, and acceleration over the frequency band 0.01 to 25 Hz. Corollaries to these hypotheses are that the range of possible fault rupture histories is narrow enough to functionally constrain the range of strong ground motion predictions, and that a discreet set of rupture histories is sufficient to span the infinite combinations possible from a given range of rupture parameters.

24753 (UCRL-JC–116524) **The Beaverhead impact structure, SW Montana and Idaho: Implications for the regional geology of the western U.S.** Fiske, P.S.; Hargaves, R.B. Lawrence Livermore National Lab., CA (United States). 17 Mar 1994. 18p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Geological Survey, Reston, VA (United States). DOE Contract W-7405-ENG-48. Grant EAR 92-05975. (CONF-9308269–1: 3. the belt symposium, Whitefish, MT (United States), 14-21 Aug 1993). Order Number DE95014513. Source: OSTI; NTIS; GPO Dep.

The Beaverhead impact structure in SW Montana and Idaho is an allochthonous fragment of a large impact structure (~ 100 km diameter) that was transported some distance eastward during the Cretaceous Sevier orogeny. It is the first tectonic fragment of a large impact structure identified in the geologic record. The present evidence for impact consists of shatter cones, pseudotachylites, and planar deformation features in quartz. The age of the impact is not well constrained but is estimated to be Neoproterozoic to Cambrian (1000-500 Ma). The Beaverhead impact event must have created other features that may be preserved, elsewhere in western Montana and Idaho. These include proximal and distal ejecta (which may be misinterpreted as diamictites and/or tuff horizons) and other fragments of the crater floor containing shatter cones and pseudotachylite. A large circular gravity, magnetic and topographic anomaly, which could be the root of the impact structure, has been identified near Challis, Idaho. An enigmatic lithic tuff, identified in drill cores from the Challis area and an intraformational quartzite breccia in the Leaton Gulch area may be impact-related deposits, but no definitive evidence of shock metamorphism has been observed in these materials. The discovery of more pieces of the Beaverhead puzzle, as well as the recognition of other large impacts in the geologic record, are likely once the regional geologic community grows to accept the incidence of such events and becomes more familiar with the features of shock metamorphism in the field. To that end, the community of geologists in this area should integrate the Beaverhead structure into their research and teaching curriculum.

66 PHYSICS

24754 (FNAL/C–95/064) **The Sloan Digital Sky Survey's use of the Web.** Petravick, D. (and others); Berman, E.; Gurbani, V. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Alfred P. Sloan Foundation. (CONF-9504170–1: Weaving the astronomy web conference, Strasbourg (France), 6-7 Apr 1995). Order Number DE95013240. Source: OSTI; NTIS; GPO Dep.

The Sloan Digital Sky Survey is a world-wide collaboration in astrophysics with contributors from around the United States, Italy, and Japan. Collaborators need to have easy access to current information about the project and the on-going software development. The World Wide Web (WWW) and HTML (HyperText Markup Language meet this need admirably. Our use of the Web can be thought of as providing access to three distinct types of information: (1) the infrastructure of the project, (2) the documentation of actual software used throughout the project, and (3) access to Survey databases. The layout of Web pages is not meant to allow the public to easily surf. Rather, the pages are laid out to permit collaborators to find information efficiently. In keeping with this goal, there is less emphasis on glitz and more on content.

6610 General Physics

24755 (LA-SUB–95-69) **The role of composition gradients in the evolution of uranus and neptune. Progress report, 1 January 1994–1 September 1994.** Marley, M.S. (New Mexico State Univ., Las Cruces, NM (United States)); Glatzmaier, G. Los Alamos National Lab., NM (United States); New Mexico State Univ., Las Cruces, NM (United States). [1994]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. LANL-Subcontract-9-XX3-1442E-1. Order Number DE95012959. Source: OSTI; NTIS; GPO Dep.

Thermal evolution models of Uranus and Neptune constructed over the last two decades overestimate the current luminosities of both planets. These models have also failed to explain the disparity between the relatively large excess luminosity of Neptune and the virtually undetectable one of Uranus. Our approach is to combine planetary evolution models with numerical simulations of convection in the presence of a stabilizing composition gradient. We have begun to adapt the global convection model to the conditions found in the interiors of Uranus and Neptune. When complete this model will calculate the mass and energy fluxes across double-diffusive interfaces in the interior of each planet needed in the new evolutionary calculations.

6611 Classical and Quantum Mechanics

24756 (LBL–36537) **Differential geometry on Hopf algebras and quantum groups.** Watts, P. Lawrence Berkeley Lab., CA (United States). 15 Dec 1994. 93p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant PHY-90-21139. (UCB-PTH–94/35). Order Number DE95006572. Source: OSTI; NTIS; INIS; GPO Dep.

The differential geometry on a Hopf algebra is constructed, by using the basic axioms of Hopf algebras and noncommutative differential geometry. The space of generalized derivations on a Hopf algebra of functions is presented via the smash product, and used to define and discuss quantum Lie algebras and their properties. The Cartan calculus of the exterior derivative, Lie derivative, and inner derivation is found for both the universal and general differential calculi of an arbitrary Hopf algebra, and, by restricting to the quasitriangular case and using the numerical R-matrix formalism, the aforementioned structures for quantum groups are determined.

6612 Techniques of General Use in Physics

24757 (ANL/ET/CP–82236) **Thermal characteristics of a low-loss liquid-helium dewar.** Cha, Y.S.; Niemann, R.C.; Hull, J.R. Argonne National Lab., IL (United States). May 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950336–28: American Society of Mechanical Engineers/Japanese Society of Mechanical Engineers/Japan Solar Energy Society international solar energy conference, Lahaina, HI (United States), 19-24 Mar 1995). Order Number DE95012271. Source: OSTI; NTIS; GPO Dep.

A liquid helium dewar has been designed, fabricated, and operated successfully with a minimum background heat-loss rate of only a few milliwatts. The objective is to provide a facility that can be used to measure relatively low heat-loss rate (1–100 milliwatts) in a liquid helium environment. The experimental system consists mainly of an inner helium reservoir within an outer helium reservoir that is thermally shielded from the room-temperature environment by multiple insulation layers in a vacuum environment and a liquid nitrogen reservoir. The inner helium reservoir has a reduced cross-sectional (neck) area to minimize radiative and convective heat transfer to the liquid helium in the lower portion of the reservoir. Experimental results indicate that it takes a long time (>16 hours) for the system to cool down and reach the minimum heat-loss condition. Strong thermal interactions were observed between the inner and the outer reservoirs above the reduced cross-sectional area of the inner reservoir which is separated from the outer reservoir by a cylindrical stainless steel wall. Temperature measurements showed stratification in the vapor space above the liquid helium in the inner reservoir. Temperature distributions in the vapor space are not one-dimensional, and horizontal temperature gradients exist; this strongly suggests that natural convection may have persisted in the vapor space above the liquid helium in the inner reservoir. To alleviate the problem of strong thermal interactions between the inner and the outer reservoirs, we have since redesigned and tested an improved inner helium reservoir. The new reservoir has a heat intercept, an extended vacuum insulating space between the two helium reservoirs above the heat intercept, and an upper portion made of a thermally insulating epoxy fiberglass composite. Testing showed that interaction between the inner and the outer helium reservoirs of the new system is significantly lower than the original system.

24758 (DOE/ER/75873–T1) **Development of a novel neutron source with applications in calibration and monitoring. Final report.** Miley, G.H. Illinois Univ., Urbana, IL (United States). Apr 1995. 3p. Sponsored by USDOE, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract FG02-93ER75873. NAS7-1235. Order Number DE95015112. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this research project, development of a unique portable inertial electrostatic confinement (IEC) neutron source (10^6 2.5-MeV neutrons/second-level) has been achieved. A majority of the experimental work required for the project was reported in the 1993 Annual Report. (The abstract and table of contents for that report are included here as Appendix A for convenience. Full copies can be obtained upon request to the PI.) Unfortunately, the DOE program providing support for the project was canceled and funding was not available to continue the project in 199495. However, to provide time to explore some innovative potential applications for upgraded versions of the IEC, a no-cost extension of the contract was requested and granted in 1994. This follow-on work, mostly involving conceptual design studies, is reported here.

24759 (LA-UR–95-1539) **Application of a transverse phase-space measurement technique for high-brightness, H^- beams to the GTA H^- beam.** Johnson, K.F. (Los Alamos National Lab., NM (United States)); Garcia, R.C.; Rusthoi, D.P.; Sander, O.R.; Sandoval, D.P.; Shinas, M.A.; Smith, M.; Yuan, V.W.; Connolly, R.C. Los Alamos National Lab., NM (United States). [1995]. 4p. Sponsored by Department of the Army, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950512–144: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95011982. Source: OSTI; NTIS; INIS; GPO Dep.

The Ground Test Accelerator (GTA) had the objective Of Producing a high-brightness, high-current H-beam. The major components were a 35 keV injector, a Radio Frequency Quadrupole (RFQ), an intertank matching section (IMS), and a drift tube linac (DTL), consisting of 10 modules. A technique for measuring the transverse phase-space of high-power density beams has been developed and tested. This diagnostic has been applied to the GTA H-beam. Experimental results are compared to the slit and collector technique for transverse phase-space measurements and to simulations.

24760 (LBL-PUB–754, pp. 191-201) **Radiation and gas conduction heat transport across a helium dewer multilayer insulation system.** Green, M.A. (Lawrence Berkeley Lab., CA (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. DOE Contract AC03-76SF00098. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes a method for calculating mixed heat transfer through the multilayer insulation used to insulated a 4K liquid helium cryostat. The method described permits one to estimate the insulation potential for a multilayer insulation system from first principles. The heat transfer regimes included are: radiation, conduction by free molecule gas conduction, and conduction through continuum gas conduction. Heat transfer in the transition region between the two gas conduction regimes is also included.

6613 Other Aspects of Physical Science

Refer also to citation(s) 23471, 23802, 24022, 24381, 24391, 24617, 24805, 24858

24761 (DOE/ER/13670–T5) **Solar variability observed through changes in solar limb-darkening function and mean diameter. Progress report.** Arizona Univ., Tucson, AZ (United States). Dept. of Physics. [1995]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13670. Order Number DE95013840. Source: OSTI; NTIS; INIS; GPO Dep.

This is a progress report on work on the SCLERA project which is a ground-based program for monitoring and measuring information on solar luminosity by means of observed changes in the solar limb-darkening function, shape, and diameter. Ground based measurements offer major cost advantages over satellite systems, though offering more challenging problems in data collection and interpretation. This report discusses progress in the field of interpreting such data, and the development of instrumentation and models to account for the observed results.

24762 (DOE/ER/40537–43) **The Russian-American gallium solar neutrino experiment.** Elliott, S.R. (Univ. of Washington, Seattle, WA (United States)); Wilkerson, J.F.; Abdurashitov, J.N. Washington Univ., Seattle, WA (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER40537. Order Number DE95015921. Source: OSTI; NTIS; GPO Dep.

The Russian-American Gallium solar neutrino Experiment (SAGE) is described. The solar neutrino flux measured by 31 extractions through October, 1993 is presented. The result of 69 $\pm$ 10_{-7}^{+5} SNU is to be compared with a standard solar model prediction of 132 SNU. The status of a ^{51}Cr neutrino source irradiation to test the overall operation of the experiment is also presented.

24763 (ENEA-RT-ERG-FUS–94-29) **Implementing simulations of isotropic turbulence in highly parallel computers.** Pais, V.A. (ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione). Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy). Mar 1995. 16p. Order Number DE95789774. Source: OSTI; NTIS (US Sales Only).

The first steps for the simulation of isotropic turbulence in Newtonian incompressible fluids are done in such a way to acquire a basic knowhow. Highly parallel hardware and techniques are used following previous published papers. An elementary stability analysis is provided. The preliminary tests are carried out and the results indicate that the implemented codes are operational.

24764 (JINR-R–2-94-150) **Gravitational energy and gravitational waves.** Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1994. 159p. (In Russian). (CONF-9310435–: 6. Seminar on the gravitational energy and gravitational waves, Dubna (Russian Federation), 26-30 Oct 1993). Order Number DE95633241. Source: OSTI; NTIS (US Sales Only); INIS.

The papers of the International symposium after N.I. Lobachevsky Gravitational energy and gravitational waves at Dubna in December 1993 are presented. The main attention is paid to the gravitation theory, gravitational field energy density, gravitational waves and radiation.

24765 (LA-SUB–95-88) **Simulational studies of the Farley-Buneman in the equatorial electrojet.** Otani, N. (and others); Seyler, C.; Kelley, M. Los Alamos National Lab., NM (United States). [1995]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95014567. Source: OSTI; NTIS; GPO Dep.

The Farley-Buneman instability in the equatorial electrojet current system in the E-region of the ionosphere has been identified as the cause of the observed Type I electron density irregularities. The goal of this work was to study the instability in the equatorial region.

24766 (LBL-PUB–754, pp. 143-159) **On the smoothness of electric fields near plane gratings of cylindrical conductors.** Judd, D.L. (Lawrence Berkeley Lab., CA (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

The electric field near an infinite plane grating of equally spaced round rods at the same potential, forming the boundary of a uniform field, is determined analytically to good accuracy by conformal transformations and evaluated numerically. This contribution, which has a frankly pedagogical flavor, to the Klaus Halbach Festschrift is offered to honor his displayed mastery of conformal techniques. Although the numerical work and the form of its presentation are new, the transformation used is not original. However, to locate its antecedents in an archival journal it was necessary to seek out a paper published in 1923 (close to the year of his birth, and of mine), in a place obscure to modern physicists, so the authors efforts cannot be said to replicate recent published work. A new insight is obtained in the form of a simple estimate of departures from field uniformity at all distances from rods of any size.

24767 (LBL-PUB–754, pp. 219-242) **Some ideas on the choice of designs and materials for cooled mirrors.** Howells, M.R. (Lawrence Berkeley Lab., CA (United States)). Lawrence Berkeley Lab., CA (United States). Feb 1995. DOE Contract AC03-76SF00098. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

Here the author expresses some of his views on how the fabrication of future synchrotron beam-line optics ought to be approached. Many of the most interesting new ideas for beam-line mirrors, especially those with a promise of low costs, involve metals. Historically these materials had posed certain problems, but these have been overcome in recent times to the extent that the initial complement of Advanced-Light-Source (ALS) beam-line optics were made of metal and have met their specifications. To go furthere along that road one needs to get more interested in the metallurgical issues involved in making high-quality metal mirrors. The author recounts the results of some investigations into these materials questions and trys to draw on some of the experiences and achievements of these communities which have hitherto had only limited contact with synchrotron radiation researchers.

24768 (LNF-P–95-010) **Detection of gravitational waves with spherical antennas.** Coccia, E. (Rome Univ. II (Italy). Dipt. di Fisica); Lobo, J.A. Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Apr 1995. 25p. (CONF-9409359–1: 11. Italian conference on general relativity and gravitational physics, Trieste (Italy), 26-30 Sep 1994). Order Number DE95789750. Source: OSTI; NTIS (US Sales Only).

The authors report on an investigation of the possibilities offered by solid resonant spheres to detect gravitational radiation. A spherical detector has isotropic sensitivity and can determine the source direction and wave polarisation providing vetoes on General Relativity. A deconvolution procedure for a general gravitational wave is described, along with tests and vetoes on the trace and transversality properties of gravitational waves. The sphere's gravitational wave absorption cross section is large at two frequencies and if the wave direction is known, a spherical detector can determine all the six polarisation states predicted by the most general metric theory. Assuming General Relativity, a two sphere observatory completes the deconvolution process, removing the 180° ambiguity in the source position, enabling the determination of the gravitational wave speed and providing powerful vetoes on local disturbances. The authors discuss the sensitivity of spheres of different materials and frequencies of operation. A 3 metres diameter A15056 sphere is shown to be able to reach a 1 ms burst sensitivity of $h \approx = 6 \times 10^{-22}$ if operated at the quantum limit.

24769 (SAND–93-0499) **Boltzmann-equation simulations of radio-frequency-driven, low-temperature plasmas.** Drallos, P.J.; Riley, M.E. Sandia National Labs., Albuquerque, NM (United States). Jan 1995. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95007716. Source: OSTI; NTIS; INIS; GPO Dep.

We present a method for the numerical solution of the Boltzmann equation (BE) describing plasma electrons. We apply the method to a capacitively-coupled, radio-frequency-driven He discharge in parallel-plate (quasi-1D) geometry which contains time scales for physical processes spanning six orders of magnitude. Our BE solution procedure uses the method of characteristics for the Vlasov operator with interpolation in phase space at early time, allowing storage of the distribution function on a fixed phase-space grid. By alternating this BE method with a fluid description of the electrons, or with a novel time-cycle-average equation method, we compute the periodic steady state of a He plasma by time evolution from startup conditions. We find that the results compare favorably with measured current-voltage, plasma density, and "cited state densities in the "GEC" Reference Cell. Our atomic He model includes

five levels (some are summed composites), 15 electronic transitions, radiation trapping, and metastable-metastable collisions.

24770 (SAND–94-1735) **Velocity boundary conditions for vorticity formulations of the incompressible Navier-Stokes equations.** Kempka, S.N. (Sandia National Labs., Albuquerque, NM (United States)); Strickland, J.H.; Glass, M.W.; Peery, J.S.; Ingber, M.S. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012525. Source: OSTI; NTIS; GPO Dep.

formulation to satisfy velocity boundary conditions for the vorticity form of the incompressible, viscous fluid momentum equations is presented. The tangential and normal components of the velocity boundary condition are satisfied simultaneously by creating vorticity adjacent to boundaries. The newly created vorticity is determined using a kinematical formulation which is a generalization of Helmholtz' decomposition of a vector field. Though it has not been generally recognized, these formulations resolve the over-specification issue associated with creating voracity to satisfy velocity boundary conditions. The generalized decomposition has not been widely used, apparently due to a lack of a useful physical interpretation. An analysis is presented which shows that the generalized decomposition has a relatively simple physical interpretation which facilitates its numerical implementation. The implementation of the generalized decomposition is discussed in detail. As an example the flow in a two-dimensional lid-driven cavity is simulated. The solution technique is based on a Lagrangian transport algorithm in the hydrocode ALEGRA. ALEGRA's Lagrangian transport algorithm has been modified to solve the vorticity transport equation and the generalized decomposition, thus providing a new, accurate method to simulate incompressible flows. This numerical implementation and the new boundary condition formulation allow vorticity-based formulations to be used in a wider range of engineering problems.

24771 (UCRL-ID–120746) **A search for optical counterparts of gamma-ray bursts. Final report.** Park, Hye-Sook. Lawrence Livermore National Lab., CA (United States). 9 Mar 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013248. Source: OSTI; NTIS; GPO Dep.

Gamma Ray Bursts (GRBS) are mysterious flashes of gamma rays lasting several tens to hundreds of seconds that occur approximately once per day. NASA launched the orbiting Compton Gamma Ray Observatory to study GRBs and other gamma ray phenomena. CGRO carries the Burst and Transient Experiment (BATSE) specifically to study GRBS. Although BATSE has collected data on over 600 GRBS, and confirmed that GRBs are localized, high intensity point sources of MeV gamma rays distributed isotropically in the sky, the nature and origin of GRBs remains a fundamental problem in astrophysics. BATSE's 8 gamma ray sensors located on the corners of the box shaped CGRO can detect the onset of GRBs and record their intensity and energy spectra as a function of time. The position of the burst on the sky can be determined to $< \pm 10^{\circ}$ from the BATSE data stream. This position resolution is not sufficient to point a large, optical telescope at the exact position of a GRB which would determine its origin by associating it with a star. Because of their brief duration it is not known if GRBs are accompanied by visible radiation. Their seemingly large energy output suggests thatthis should be. Simply scaling the ratio of visible to gamma ray intensities of the Crab Nebula to the GRB output suggests that GRBs ought to be accompanied by visible flashes of magnitude 10 or so. A few photographs of areas containing a burst location that were coincidentally taken during the burst yield lower limits on visible output of magnitude 4. The detection of visible light during the GRB would provide information on burst physics, provide improved pointing coordinates for precise examination of the field by large telescope and provide the justification for larger dedicated optical counterpart instruments. The purpose of this experiment is to detect or set lower limits on optical counterpart radiation simultaneously accompanying the gamma rays from.

24772 (UCRL-JC–120862) **EUVE photometry of SS Cygni: Dwarf nova outbursts and oscillations.** Mauche, C.W. Lawrence Livermore National Lab., CA (United States). 15 May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9503167–1: 1995 International Astronomical Union (IAU) colloquium #152 on astrophysics in the extreme ultraviolet, Berkeley, CA (United States), 27-30 Mar 1995). Order Number DE95014394. Source: OSTI; NTIS; GPO Dep.

The authors present EUVE Deep Survey photometry and AAVSO optical measurements of the 1993 August and 1994 June/July outbursts of the dwarf nova SS Cygni. The EUV and optical light curves are used to illustrate the different response of the accretion disk to outbursts which begin at the inner edge and propagate outward, and those which begin at the outer edge and propagate inward. Furthermore, the authors describe the properties of the quasi-coherent 7–9 s sinusoidal oscillations in the EUV flux detected during the rise and plateau stages of these outbursts.

6620 Physics of Elementary Particles and Fields

Refer also to citation(s) 24292

24773 (ANL-HEP-TR–95-26) **High Energy Physics Division semiannual report of research activities, July 1, 1994–December 31, 1994.** Wagner, R.; Schoessow, P.; Talaga, R. Argonne National Lab., IL (United States). Apr 1995. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95013583. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the research conducted in the High Energy Physics Division of Argonne National Laboratory during the period of July 1, 1994–December 31, 1994. Topics covered here include experimental and theoretical particle physics, advanced accelerator physics, detector development, and experimental facilities research. Lists of division publications and colloquia are included.

24774 (DOE/ER/10690–11) **1991 Technical progress report of the University of South Carolina's High Energy Physics Group, February 1990–July 1991.** South Carolina Univ., Columbia, SC (United States). [1991]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AS09-80ER10690. Order Number DE95016073. Source: OSTI; NTIS; INIS; GPO Dep.

The high energy physics group at the University of South Carolina includes five teaching faculty members, one research faculty member, and five graduate students. Profs. Childers, Darden, and Wilson devote most of their research effort to Fermilab experiment E789, which is designed to observe charmless two-body decays of b-flavored mesons and baryons. Prof. Wilson works on Fermilab experiment E687 which studies charm physics in the wide-band photon beam. Profs. Rosenfeld and Wang participate in the AMY collaboration, which studies electron-positron interactions using the TRISTAN collider at KEK. Prof. Rosenfeld and one student collaborate with personnel from KEK and INS, Tokyo, on an experiment to detect a 17 keV neutrino in the β-decay spectrum of ^{63}Ni. Members of the group also participate in Fermilab Proposal P803 which will search for the oscillation of muon neutrino to tau neutrino with sensitivity better than a factor of 40 than previously achieved and in Superconducting Super Collider activities which include the development of an imaging preradiator. A brief discussion is given on progress made for each program.

24775 (DOE/ER/10690–12) **1992 Technical progress report of the University of South Carolina's High Energy Physics Group.** South Carolina Univ., Columbia, SC (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AS09-80ER10690. Order Number DE95016070. Source: OSTI; NTIS; INIS; GPO Dep.

The high energy physics group at the University of South Carolina includes five teaching faculty members, one research faculty member, and five graduate students. Professors Childers and Darden devote most of their research effort to Fermilab experiment E789, which is designed to observe charmless two-body decays of b-flavored mesons and baryons. Prof. Wilson works on E789 and also on Fermilab experiment E687 which studies charm physics in the wide-band photon beam. Professors Rosenfeld and Wang participate in the AMY collaboration, which studies electron-positron interactions using the TRISTAN collider at KEK. Prof. Rosenfeld and one student collaborate with personnel from KEK and INS,

Tokyo, on an experiment to detect a 17 keV neutrino in the β-decay spectrum of ^{63}Ni. Profs. Avignone and Rosenfeld are charter members of Fermilab proposal P803, which will search for the oscillation of muon neutrino to tau neutrino with sensitivity better than a factor of 40 than previously achieved. A brief discussion on the progress of each program is given.

24776 (DOE/ER/40272–213) **Research in theoretical elementary particle physics at the University of Florida: Task A. Annual progress report.** Field, R.D.; Ramond, P.M.; Sikivie, P.; Thorn, C.B. Florida Univ., Gainesville, FL (United States). 1 Dec 1994. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER40272. (UFIFT-HEP–94-18). Order Number DE95010162. Source: OSTI; NTIS; INIS; GPO Dep.

This is the Annual Progress Report of the theoretical particle theory group at the University of Florida under DOE Grant DE-FG05-86ER40272. At present our group consists of four Full Professors (Field, Ramond, Thorn, Sikivie), one Associate Professor (Woodard), and two Assistant Professors (Qiu, Kennedy). In addition, we have four postdoctoral research associates and seven graduate students. The research of our group covers a broad range of topics in theoretical high energy physics including both theory and phenomenology. Included in this report is a summary of the last several years, an outline of our current research program.

24777 (SSCL-Preprint–542) **Physics Research Integrated Development Environment (PRIDE).** Burton, J.; Cormell, L. Superconducting Super Collider Lab., Dallas, TX (United States). Dec 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011152. Source: OSTI; NTIS; INIS; GPO Dep.

Past efforts to implement a Software Engineering approach to High Energy Physics computing have been met with significant resistance and have been, in many cases, only marginally successful. At least a portion of the problem has been the Lick of an integrated development environment, tailored to High Energy Physics and incorporating a suite of Computer Aided Software Engineering tools. The Superconducting Super Collider Physics Research Division Computing Department is implementing pilot projects to develop just such an environment.

24778 (SSCL-Preprint–552) **Review of experiments.** Lueth, V. Superconducting Super Collider Lab., Dallas, TX (United States). Aug 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930823–22: 15. international symposium on lepton and photon interactions, Ithaca, NY (United States), 10-15 Aug 1993). Order Number DE95011155. Source: OSTI; NTIS; INIS; GPO Dep.

While progress in particle physics may not be as swift as most scientists would like it to be, the data sample presently available has brought us a wealth of new information, all of which appears to cement the Standard Model. This report summarizes the most important results extracted from the many excellent review talks presented at this Symposium. Subject areas addressed here are: properties of neutral and charged leptons; search for rare decays; hadron structure and rare decays; standard model parameters; CP and CPT violation; heavy flavor physics; charm physics; beauty physics; B^0-$\bar{B}^0$ mixing; and unitarity triangle.

24779 (SSCL-SR–1173) **Electroweak and flavor physics: Implications for the SSC. Second annual SSCL spring conference.** Superconducting Super Collider Lab., Waxahachie, TX (United States). [1991]. 1114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-9105208–Vugraphs: 2. annual superconducting super collider (SSCL) conference on electroweak and flavor physics: implications for the SSC, Waxahachie, TX (United States), 20-23 May 1991). Order Number DE95011027. Source: OSTI; NTIS; INIS; GPO Dep.

This book is a collection of vugraphs for the papers given at the conference. The following topics are covered: neutrino physics and dark matter; solar neutrinos; kaon decays; future prospects in high energy physics (non SSC); bottom quark physics; status and physics aims of SSC; and SSC possibilities for B physics.

6621 General Theory of Particles and Fields

Refer also to citation(s) 24764, 24801

24780 (FNAL/C–95/117) **Hadron collider B factories.** Butler, J.N. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1995. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-950285–4: LAFEX international school in high energy physics, Rio de Janeiro (Brazil), 20 Feb 1995). Order Number DE95014565. Source: OSTI; NTIS; INIS; GPO Dep.

The potential of hadron colliders to explore the physics of CP violation in B decays is discussed.

6622 Specific Theories and Interaction Models; Particle Systematics

Refer also to citation(s) 24787, 24794, 24800

24781 (CIEMAT–756) **Determination of the electroweak parameters of the b quark.** No corporate text available. 1995. 65p. (In Spanish). Order Number DE95780846. Source: OSTI; NTIS; INIS.

In the present work we analyze the process e+e→ bb with the data collected during 1991 and 1992 by the L_3 detector situated in the LEP e+e- storage-ring (CERN). From the measurements of the crossections and the charge asymmetry we determine the parameters of the b quark in the framework of the Standar Model. Finally, we parametrize the possible deviations from the model an obtain upper and lower limits for the mass of the t quark.

24782 (DOE/ER/40561–193) **Finite-temperature corrections in the dilated chiral quark model.** Kim, Y. (Hanyang Univ., Seoul (Korea, Republic of). Dept. of Physics); Lee, Hyun Kyu; Rho, M. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. Mar 1995. 18p. Sponsored by USDOE, Washington, DC (United States);Korea Science and Engineering Foundation (Korea, Republic of);Korea Ministry of Education (Korea). DOE Contract FG06-90ER40561. G 94-1400-04-01-3; G bsri-94-2441. Order Number DE95012174. Source: OSTI; NTIS; INIS; GPO Dep.

We calculate the finite-temperature corrections in the dilated chiral quark model using the effective potential formalism. Assuming that the dilaton limit is applicable at some short length scale, we interpret the results to represent the behavior of hadrons in dense and hot matter. We obtain the scaling law, $f_\pi(T)/f_\pi = m_Q(T)/m_Q \simeq m_\sigma(T)/m_\sigma$ while we argue, using PCAC, that pion mass does not scale within the temperature range involved in our Lagrangian. It is found that the hadron masses and the pion decay constant drop faster with temperature in the dilated chiral quark model than in the conventional linear sigma model that does not take into account the QCD scale anomaly. We attribute the difference in scaling in heat bath to the effect of baryonic medium on thermal properties of the hadrons. Our finding would imply that the AGS experiments (dense and hot matter) and the RHIC experiments (hot and dilute matter) will "see" different hadron properties in the hadronization exit phase.

24783 (FNAL/C–95/115-E) **Photon and diphoton production at CDF and D0.** Lamoureux, J.I. (Brandeis Univ., Waltham, MA (United States)). CDF Collaboration; D0 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–3: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95013237. Source: OSTI; NTIS; INIS; GPO Dep.

Measurements of prompt photon production in $\bar{p}p$ collisions at $\sqrt{s}$ = 1.8 TeV from the CDF and D0 experiments at Fermilab are presented. The measured inclusive isolated photon spectrum at CDF and D0 are used to test current parton distribution functions and NLO QCD predictions. No new resonance is found in the photon + jet mass spectrum from D0 which is consistent with NLO QCD predictions. The pseudorapidity distribution of the leading jet in photon events at CDF is used to constrain the parton distribution sets while the angular distribution is found to be better explained

by a larger Bremsstrahlung contribution. The soft diphoton spectrum is compared to NLO QCD predictions. The diphoton system P_T is found to agree better with the LO shower monte-carlo prediction of Pythia than NLO QCD. Finally, the γ + charm cross section is measured and compared to the LO Pythia prediction.

24784 (JINR-D–9-92-455, pp. 19-29) **Hot problems of standard model and what behind it.** Efremov, A.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 500p. (In Russian). (CONF-9210224–: 13. national particle accelerator conference, Dubna (Russian Federation), 13-15 Oct 1992). In *Proceedings of the 13. workshop on charged particle accelerators. Volume 1.* Order Number DE95633506. Source: OSTI; NTIS (US Sales Only); INIS.

Major problems of the standard model of strong, weak and electromagnetic interactions, that is to say quantum chromodynamics and the theory of electroweak interactions are considered. 9 figs.

24785 (LA-UR–95-1489) **The rotationally improved Skyrmion, or RISKY.** Dorey, N. (University of Wales, Swansea (United Kingdom). Dept. of Physics); Mattis, M.P. Los Alamos National Lab., NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950293–1: Nuclear and particle physics conference, Seoul (Korea, Republic of), 6-10 Feb 1995). Order Number DE95011993. Source: OSTI; NTIS; INIS; GPO Dep.

The perceived inability of the Skyrme model to reproduce pseudovector pion-baryon coupling has come to be known as the "Yukawa problem." In this talk, we review the complete solution to this problem. The solution involves a new configuration known as the rotationally improved Skyrmion, or "RISKY," in which the hedgehog structure is modified by a small quadrupole distortion. We illustrate our ideas both in the Skyrme model and in a simpler model with a global U(I) symmetry.

24786 (SSCL-Preprint–496) **Light threshold effects in supersymmetric grand unified theories.** Faraggi, A.E. (Weizmann Institute of Science, Rehovot (Israel). Dept. of Physics); Grinstein, B. Superconducting Super Collider Lab., Dallas, TX (United States). Aug 1993. 36p. Sponsored by USDOE, Washington, DC (United States);Sloan (Alfred P.) Foundation, New York, NY (United States);Feinberg School Fellowship (United States). DOE Contract AC35-89ER40486. (WIS–93/61/JULY-PH). Order Number DE95011202. Source: OSTI; NTIS; INIS; GPO Dep.

Supersymmetric Grand Unified Theories have a rich spectrum of particles barely heavier than the intermediate vector bosons. As their non-supersymmetric counterparts, they lead to many relations among low energy observables. But the precise form of the predictions is modified by the extended spectrum. If the masses of these new particles are comparable to M_Z, the standard computation of their effect becomes inaccurate. The authors, present a detailed discussion of the correct procedure, and carry out the relevant computations to one loop order. Attention is paid to the special treatment that the top and Higgs particles must receive. The size of the effect is explored for a range of parameters in the minimal supersymmetric SU(5) grand-unified theory with radiative breaking. It is found that the naive (leading-log) computation can be fairly inaccurate.

6623 Specific Interactions, Decays and Processes

Refer also to citation(s) 24780, 24783, 24815

24787 (DOE/ER/40771–T1) **Theoretical studies in high energy nuclear physics. Progress report.** Pennsylvania State Univ., University Park, PA (United States). Dept. of Physics. [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-93ER40771. Order Number DE95016141. Source: OSTI; NTIS; INIS; GPO Dep.

This paper is a progress report for the period 1-1-93 to 6-30-95 on a project primarily directed at the application of high energy physics techniques to nuclear structure studies, and the ability to study hadron dynamics through interactions with nuclear targets. This work has included the first legitimate QCD calculations of hard coherent diffractive processes off nucleon (nuclear) targets which established novel features of color transparency phenomenon not anticipated in the previous intuitive or QCD inspired model calculations and predicted the fast increase of the cross section for electroproduction of ρ-mesons with increase of the energy, which was confirmed very recently by the first HERA data on this reaction. First theoretical demonstration that color transparency phenomenon for the hard diffractive processes follow from QCD in the kinematics when both $x \to 0$ and $Q^2 \to \infty$. Establishing the pattern of color (cross section) fluctuations in hadrons. Confirmed by the FNAL inelastic diffraction data. Finding that in realistic quark, skyrmion models of a hadron large momentum transfer elastic lepton-hadron scattering occurs through formation of small spatial size configurations. Discovering a novel class of color transparency sensitive double interaction processes which is complementary to quasielastic reactions originally suggested by S. Brodsky and A. Mueller. Adopting ideas suggested elsewhere for hadron initiated reactions they developed a method for taking into account nuclear correlations in (e,e'p) reactions. Such an approach gives practical possibility to overcome ambiguities of optical model approximation used before and to reliably interpret color transparency effects at intermediate Q^2.

24788 (FNAL/C–95/046-E) **Proton and deuteron structure functions in muon scattering at 470 GeV.** Kotwal, A.V. (Harvard Univ., Cambridge, MA (United States). Dept. of Physics). E665 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–7: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95013587. Source: OSTI; NTIS; INIS; GPO Dep.

The proton and deuteron structure functions F_2^p and F_2^d measured in inelastic muon scattering with an average beam energy of 470 GeV. The data were taken at Fermilab experiment 665 during 1991-1992 using liquid hydrogen and deuterium targets. The F_2 measurements are reported in the range $0.0008 < x < 0.6$ and $0.2 < Q^2 < 75$ GeV^2. These are the first precise measurements of F_2 in the low x and Q_2 range of the data. The E665 data overlap in x with the HERA data, and there is a smooth connection in Q^2 between the two data sets. At high Q^2 the E665 measurements are consistent with QCD-evolved leading twist structure function models. The data are qualitatively described by structure function models incorporating the hadronic nature of the photon at low Q^2. The Q^2 and the W dependence of the data measure the transition in the nature of the photon between a point-probe at high Q^2 and a hadronic object at low Q^2.

24789 (FNAL/C–95/096-E) **Charm and beauty results from CDF and D0.** Derwent, P. (Michigan Univ., Ann Arbor, MI (United States)). CDF and D0 Collaborations. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503147–4: Rencontres de Physique de la Valle' d'Aoste, La Thuile (Italy), Mar 1995). Order Number DE95014206. Source: OSTI; NTIS; INIS; GPO Dep.

I report, for the CDF and D0 collaborations, results from the 92-93 Tevatron Collider run concerning charm and beauty quark production and beauty meson decay properties.

24790 (FNAL/C–95/103-E) **Observation of the top quark.** Greenlee, H. D0 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503147–3: Rencontres de Physique de la Valle' d'Aoste, La Thuile (Italy), Mar 1995). Order Number DE95013002. Source: OSTI; NTIS; INIS; GPO Dep.

The DO collaboration reports on a search for the Standard Model top quark in $p\bar{p}$ collisions at $\sqrt{s} = 1.8$ TeV at the Fermilab Tevatron, with an integrated luminosity of approximately 50 pb^{-1}. We have searched for $t\bar{t}$ production in the dilepton and single-lepton decay channels, with and without tagging of b quark jets. We observe 17 events with an expected background of 3.8 ± 0.6 events. The probability for an upward fluctuation of the background to produce the observed signal is 2×10^{-6} (equivalent to 4.6 standard

deviations). The kinematic properties of the excess events are consistent with top quark decay. We conclude that we have observed the top quark and measure its mass to be 199_{-21}^{+19} (stat.) ± 22 (syst.) GeV/c^2 and its production cross section to be 6.4 $\pm$ 2.2 pb.

24791 (FNAL/C–95/109-E) **Probing pomeron structure at Fermilab.** Melese, P. CDF and D0 Collaborations. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–10: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95014660. Source: OSTI; NTIS; INIS; GPO Dep.

Using the CDF detector, dijet and W production with rapidity gaps has been searched for as evidence for hard-pomeron induced diffraction. Diffractive W's are sensitive to a pomeron with a hard-quark structure, while diffractive dijets are sensitive to both hard-gluon and hard-quark structure. No evidence of diffractive W's has been found down to the few percent level and the fraction of diffractive dijets is measured to be (-0.03 ± 0.37)%, or consistent with zero. The existence of colorless exchange between jets has been confirmed. Both the DO and CDF detectors show a statistically significant excess of dijet events with rapidity gaps between the jets at the level of 1-2% of all dijets.

24792 (FNAL/C–95/144) **A measurement of $\alpha_s(Q^2)$ from the Gross Llewellyn Smith sum rule.** Harris, D.A. (Rochester Univ., NY (United States)); Auchincloss, P.; Arroyo, C.G. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–13: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95014575. Source: OSTI; NTIS; INIS; GPO Dep.

The Gross Llewellyn Smith sum rule has been measured at different values of four-momentum transfer squared (Q^2) by combining the precise CCFR neutrino data with data from other deep-inelastic scattering experiments at lower values of Q^2. A comparison with the O (α_s^3) predictions of perturbative QCD yields a determination of α_s and its dependence on Q^2 in the range $1\text{GeV}^2 < Q^2 < 20\ \text{GeV}^2$. Low Q^2 tests have greater sensitivity to α_s (M_Z^2) than high Q^2 tests, since at low Q^2 α_s is large and changing rapidly.

24793 (FNAL/C–95/150-E) **Rare B decays and time dependent mixing at CDF.** Ragan, K.J. (McGill Univ., Montreal (Canada)). CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–14: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95014573. Source: OSTI; NTIS; INIS; GPO Dep.

We report recent results on rare B decays searches – specifically, the decay modes $B^0 \to \mu^+\mu^-$, $B^0 \to \mu^+\mu^- K^{0*}$, and $B^\pm \to \mu^+\mu^- K^\pm$ – from the CDF collaboration using data from the 1992–1993 run of the Tevatron collider. In addition, we present the first CDF measurement of time dependent $B^0 - \bar{B}^0$ mixing.

24794 (FNAL/C–95/161-E) **Jet correlation studies as a function of rapidity interval at D0.** Heuring, T.C. (Florida State Univ., Tallahassee, FL (United States)). D0 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9503158–15: 30. Rencontres de Moriond on QCD and high energy interactions, Les Arcs (France), 19-26 Mar 1995). Order Number DE95014713. Source: OSTI; NTIS; INIS; GPO Dep.

During the 1992–93 collider run of the Fermilab Tevatron the D0 experiment accumulated a large sample of events with jets in the final state. Since the D0 detector can trigger on jets over the entire pseudorapidity range $|\eta| < 3.2$, we collected a sample of events containing jets separated by large rapidity intervals. Such events may not be well described by LO or NLO QCD perturbative calculations due to the increased importance of additional gluon radiation which tends to decorrelate the leading jets in the event. These contributions can be included using a leading-log approximation (LLA) where the leading logarithmic terms are resummed calculation of Del Duca and Schmidt. We present the first experimental measurement of jet-jet ϕ correlations as a function of the rapidity interval of the η ordered jets. We compare these results to JETRAD, HERWIG and BFKL resummation predictions.

24795 (JINR–94-1, pp. 64-65) **A search for centrally produced non-q q-bar mesons in proton proton interactions at 450 GeV/c by using the CERN Ω spectrometer.** Malyukov, S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Minashvili, I.; Romanovskij, V. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref., 3 figs. MESONS/particle production; PROTON-PROTON INTERACTIONS; GEV RANGE 100-1000; MESONS

24796 (JINR–94-1, pp. 74-75) **Search for electron neutrino oscillations and investigation of neutrino-nucleon interactions at the accelerator U-70.** Barabash, L. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Batusov, Yu.; Bunyatov, S. Joint Inst. for Nuclear Research, Dubna (Russian Federation); Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1994. In *Annual report 1993.* 95p. Order Number DE95631720. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref., 2 figs. NEUTRINO-NUCLEON INTERACTIONS/inclusive interactions; ELECTRON NEUTRINOS; GEV RANGE 01-10; GEV RANGE 10-100; LIMITING VALUES; MUON NEUTRINOS; NEUTRINO OSCILLATION; PARTICLE PRODUCTION; PROTON-NUCLEON INTERACTIONS; TOTAL CROSS SECTIONS

24797 (JINR-E–4-94-123, pp. 47-48) **Current status of $\pi\pi$-scattering experiments.** Strober, H. (Giessen Univ. (Germany)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 15 refs., 1 fig. PION-PION INTERACTIONS/scattering lengths; NUCLEONS; PION-NUCLEON INTERACTIONS; PIONS; SCATTERING AMPLITUDES; THRESHOLD ENERGY

24798 (JINR-E–4-94-123, pp. 50) **Covariant cluster dynamics of nucleons and mesons.** Habersettl, H. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. CLUSTER MODEL/mesons; CLUSTER MODEL/nucleons; MESONS; NUCLEONS

24799 (JINR-E–4-94-123, pp. 75) **Production of charged pions in neutron-proton collisions.** Bannwarth, A. (Freiburg Univ. (Germany). Fakultaet fuer Physik); Fischer, H.; Franz, J. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. PIONS MINUS/particle production; PIONS PLUS/particle production; ANGULAR DISTRIBUTION; DIFFERENTIAL CROSS SECTIONS; MEV RANGE 100-1000; NUCLEONS; PROTON-NEUTRON INTERACTIONS

24800 (LBL–36499) **Photon-photon colliders.** Sessler, A.M. Lawrence Berkeley Lab., CA (United States). Apr 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-950512–261: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014869. Source: OSTI; NTIS; INIS; GPO Dep.

Since the seminal work by Ginsburg, et at., the subject of giving the Next Linear Collider photon-photon capability, as well as electron-positron capability, has drawn much attention. A 1990 article by V.I. Teinov describes the situation at that time. In March 1994, the first workshop on this subject was held. This report briefly reviews the physics that can be achieved through the photon-photon channel and then focuses on the means of achieving such a collider. Also reviewed is the spectrum of backscattered Compton photons – the best way of obtaining photons. We emphasize the spectrum actually obtained in a collider with both polarized electrons and photons (peaked at high energy and very different from a Compton spectrum). Luminosity is estimated for the presently considered colliders, and interaction and conversion-point geometries are described. Also specified are laser requirements (such as wavelength, peak power, and average power) and the lasers that might be employed. These include conventional and free-electron lasers. Finally, we describe the R&D necessary to make either of these approaches viable and explore the use of the SLC as a test bed for a photon-photon collider of very high energy.

24801 (SLAC–451, pp. 390-398) **Mixing-induced CP violation in the $D^0\bar{D}^0$ system.** Izen, J.M. (Univ. of Texas, Dallas, TX (United States)). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1994. (CONF-9408190–: Tau-Charm factory in the era of B-factories and CESR conference, Stanford, CA (United States), 15-16 Aug 1994). In *The Tau-Charm Factory in the ERA of B-Factories and CESR.* 763p. Order Number DE95007894. Source: OSTI; NTIS; INIS; GPO Dep.

The author discusses mixing-induced CP violation which can be studied in the $D^0\bar{D}^0$ system. He reviews work presented in a previous study on Tau Charm Factories for this system. The study is based on the e^+e^- reaction yielding $D^0\bar{D}^0$ and perhaps a gamma or π^0, which decay to a shared final state plus hadronic, or semileptonic, or $l^{\pm}X$, or $K^{\pm}X$. The author also reviews the question of the appropriate CM energy to study this reaction at, based on cross sections and abilities to reject backgrounds.

24802 (SSCL–463) **Total cross sections of beauty and charmed mesons on protons.** Fridman, A. (Paris-7 Univ., 75 (France). Lab. de Physique Nucleaire et Hautes Energies); Meshkov, S. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1991. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011150. Source: OSTI; NTIS; INIS; GPO Dep.

Using a simple scaling law we predict the values of the total cross sections $\sigma(B\pm p)$, $\sigma B_{d,s}{}^0$, $\sigma(\bar{B}_{d,s}{}^0 P)$, $\sigma(D_{d,s}{}^{\pm} P)$, $\sigma(D^0 p)$, $\sigma(\bar{D}^0 p)$ from known total K_p cross sections. We assume that mesons with the same light valence quark, q, and differing only by their heavy valence quark content, Q, have total cross sections on protons which scale as the inverse of the nth power of the reduced mass of the meson. We predict that $\sigma(Q\bar{q})p > \sigma(\bar{Q}q)p$.

24803 (SSCL-SR–1218) **Coherent production of ε^+ particles in crystal using proton beam from SSC.** Okorokov, V.V. (ITER, Moscow, (Russian Federation)); Dubin, A.Yu. Superconducting Super Collider Lab., Dallas, TX (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011203. Source: OSTI; NTIS; INIS; GPO Dep.

The unique possibilities of the SSC can be ideally used for a new generation of coherent generation experiments with relativistic protons which require 20 Tev energy of the incident beam. The availability of 20 Tev proton beam at SSC allows new experiments on coherent production of ε^+ particle by relativistic proton in crystal. Experiment carried out at low energies can now be extended with protons in very narrow energy region (resonance energy, which easy can be calculated) using the new accelerator facilities at SSC. We propose to study coherent production via the Coulomb field of the cristal atoms to excite the transition $p + \gamma \rightarrow \varepsilon^+$ (1189).

6624 Properties of Specific Particles and Resonances

Refer also to citation(s) 24788, 24789, 24790, 24791, 24800, 24801, 24802, 24803

24804 (JINR-E–4-94-123) **Mesons and nuclei at intermediate energies. International conference. Book of abstracts.** Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

The book of abstracts on international conference Mesons and nuclei at intermediate energies is given. Special attention is paid to meson structure, pion reactions and currents with meson exchange.

6630 Nuclear Physics

24805 (DOE/ER/40537–37) **University of Washington, Nuclear Physics Laboratory annual report, 1995.** Washington Univ., Seattle, WA (United States). Nuclear Physics Lab. Apr 1995. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER40537. Order Number DE95015920. Source: OSTI; NTIS; INIS; GPO Dep.

The Nuclear Physics Laboratory of the University of Washington supports a broad program of experimental physics research. The current program includes in-house research using the local tandem Van de Graff and superconducting linac accelerators and non-accelerator research in double beta decay and gravitation as well as user-mode research at large accelerator and reactor facilities around the world. This book is divided into the following areas: nuclear astrophysics; neutrino physics; nucleus-nucleus reactions; fundamental symmetries and weak interactions; accelerator mass spectrometry; atomic and molecular clusters; ultra-relativistic heavy ion collisions; external users; electronics, computing, and detector infrastructure; Van de Graff, superconducting booster and ion sources; nuclear physics laboratory personnel; degrees granted for 1994–1995; and list of publications from 1994–1995.

6631 Nuclear Structure

Refer also to citation(s) 24782, 24818

24806 (BNL–61912) **Structure and collectivity very far from stability: Coulomb excitation of radioactive nuclear beams in inverse kinematics.** Brenner, D.S. (Clark Univ., Worcester, MA (United States)); Gill, R.L.; Casten, R.F.; Barton, C.J.; Zamfir, N.V. Brookhaven National Lab., Upton, NY (United States). [1995]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950660–1: International conference on exotic nuclei and atomic masses, Arles (France), 19-23 Jun 1995). Order Number DE95014642. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. RADIOACTIVE ION BEAMS/coulomb excitation; NUCLEAR STRUCTURE; COLLECTIVE MODEL; OSMIUM 188

24807 (BNL–61913) **Phonon and intruder structures in neutron rich Cd nuclei: Extension to ^{122}Cd.** Brenner, D.S. (Clark Univ., Worcester, MA (United States)); Zamfir, N.V.; Gill, R.L.; Casten, R.F.; Wolf, A. Brookhaven National Lab., Upton, NY (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950660–2: International conference on exotic nuclei and atomic masses, Arles (France), 19-23 Jun 1995). Order Number DE95014641. Source: OSTI; NTIS; INIS; GPO Dep.

Short communciation.

24808 (INS–1079) **New approach to the width of giant dipole resonance in hot nuclei.** Dinh Dang, N.; Sakata, Fumihiko. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Dec 1994. 29p. Order Number DE95789263. Source: OSTI; NTIS; INIS.

A new approach describing the width of the giant dipole resonance (GDR) in hot nuclei is proposed. The GDR is generated by the ph excitations within the finite-temperature RPA (FTRPA), while its damping at finite temperature arises from the anharmonic coupling of ph configurations to the thermal pp and hh ones beyond the FTRPA. A unification of the quantal and thermal spreading widths is undertaken within the framework of motional damping. The numerical calculations are performed by using a schematic

model with equally degenerate equidistant shells for a hot nucleus of mass A = 112 carrying no angular momentum. They give a good agreement with the behavior of the recent experimental data. A possibility of an existence of low-lying mode, to which the GDR collectivity is transferred, and a limiting temperature for the GDR in very hot nuclei are discussed. (author).

24809 (INS–1081) **A possible microscopic description of nuclear collective rotation in band-crossing region. Occurrence mechanism of s-band.** Marumori, Toshio (Tokyo Univ. (Japan). Dept. of Physics); Sakata, Fumihiko; Une, Tsutomu; Tanaka, Takeshi; Onoda, Akira. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Dec 1994. 33p. Order Number DE95789264. Source: OSTI; NTIS; INIS.

From the standpoint of the nuclear many-body problem, a possible microscopic description of nuclear collective rotation in the band-crossing region is proposed with the purpose to disclose dynamical interweaving between the particle motion and the collective rotation. According to the theory, a microscopic background of both the 'particle-plus-rotor model' and the 'rotating shell model' is given, and occurrence mechanism of the s-band is clarified. (author).

24810 (JINR-E–4-94-123, pp. 64) **Spin-density matrix of the δ-hole states.** Balashov, V.V. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Bibikov, A.V.; Vostroknutova, O.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. NUCLEI/delta baryons; DENSITY MATRIX; ENERGY LEVELS; NUCLEI; SPIN

6632 Radioactivity and Electromagnetic Transitions (Excluding Fission)

24811 (LBL–37254) **B^--decay and cosmic-ray half-life of ^{54}Mn.** Kibedi, T. (Australian National Univ., Canberra, ACT (Australia)); Kerr, M.; Dracoulis, G.D.; Byrne, A.P.; Norman, E.B. Lawrence Berkeley Lab., CA (United States). May 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9508122–3: 24. international cosmic rays conference (ICRC), Rome (Italy), 28 Aug - 8 sep 1995). Order Number DE95014769. Source: OSTI; NTIS; INIS; GPO Dep.

A superconducting solenoid electron spectrometer operated in the lens mode was adapted to search for the β^--decay of ^{54}Mn. The Compton-electron and other instrumental backgrounds have been significantly reduced by special shielding of the absorber system. An improved procedure has been developed to select the events by momenta. A limit of 2.7×10^{-5} has been established for the β^- branch.

24812 (LNF-P–95-015) **Tau decays into kaons.** Finkemeier, M. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati); Mirkes, E. Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Apr 1995. 21p. Order Number DE95789753. Source: OSTI; NTIS (US Sales Only).

Predictions for semi-leptonic decay rates of the τ lepton into two meson final states and three meson final states are derived. The hadronic matrix elements are expressed in terms of form factors, which can be predicted by chiral Lagrangians supplemented by informations about all possible low-lying resonances in the different channels. Isospin symmetry relations among the different final states are carefully taken into account. The calculated brancing ratios are compared with measured decay rates where data are available.

24813 (UCRL-JC–119301) **Decay of the ^{194}Pb superdeformed band.** Brinkman, M.J. (Oak Ridge National Lab., TN (United States)). Lawrence Livermore National Lab., CA (United States). 9 Dec 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9408213–2: Conference on physics from large gamma-ray detector arrays, Berkeley, CA (United States), 2-6 Aug 1994). Order Number DE95011756. Source: OSTI; NTIS; INIS; GPO Dep.

Three experiments using the ^{174}Yb(^{25}Mg,5n) reaction at a beam energy of 130 MeV have been performed utilizing the Early Implementation of GAMMASPHERE. The goal of these experiments was to study the decay of the known superdeformed states in ^{194}Pb to the normal low-lying levels in this nucleus. The statistical decay of these band appears to be suppressed with respect to its ^{194}Hg isobar. A single discrete transition at 2.746(2) MeV in coincidence with both the superdeformed band and the normal states through which it decays has been identified in these experiments. The evidence for this transition and a discussion of its placement will be presented.

6634 Specific Nuclear Reactions and Scattering

Refer also to citation(s) 24787, 24804, 24813

24814 (ANL/NDM–132) **Neutron interaction with doubly-magic ^{40}Ca.** Smith, A.B. (Argonne National Lab., IL (United States)). Argonne National Lab., IL (United States). Nov 1993. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95013544. Source: OSTI; NTIS; INIS; GPO Dep.

Differential neutron elastic and inelastic-scattering cross sections of elemental calcium (96.94% doubly-magic ^{40}Ca) are measured from $\approx$ 1.5 to 10 MeV with sufficient detail to determine their energy-averaged behavior in the highly fluctuating environment. These results, combined with values previously reported in the literature, are assessed in the contexts of optical-statistical, dispersive optical, and coupled-channels models, applicable to the energy domain 0 $\rightarrow$ 30+ MeV, with particular emphasis on the lower energies where the interpretations are sensitive to the dispersion relationship and the effective mass. The interpretations define the energy dependencies of the potential parameters (resolving prior ambiguities), suggest that previous estimates of the prominent low-energy (n,p) and (n,a) reactions are too large, reasonably describe observables to at least 30 MeV, and provide a vehicle for extrapolation into the bound-state regime that gives a good description of hole- and particle-state binding energies. The resulting real-potential parameters (in contrast to many ^{40}Ca parameters reported in the literature) are shown consistent with global trends.

24815 (CONF-9403151–3) **Thirteen years of pair production.** Strayer, M.R. Oak Ridge National Lab., TN (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Atomic collisions; Oak Ridge, TN (United States); 3-5 Mar 1994. Order Number DE95013205. Source: OSTI; NTIS; INIS; GPO Dep.

This talk surveys a thirteen-year collaboration with Chris Bottcher on various aspects of strong field electrodynamics. Most of the work centers on the atomic physics associated with the peripheral collisions of ultrarelativistic heavy atoms. The earliest, beginning in about 1979, dealt with the spontaneous emission of positrons from nuclear quasimolecules and touched briefly on the formation of axions as a possible explanation of the anomalous peaks in the spectrum. This work stimulated the extensive studies of particle production from coherent fields that laid the foundations for investigations of nuclear form factors, structure functions, and production mechanisms for the Higgs and other exotic particles. Chris conjectured that the strong fields that are present in these collisions would give rise to nonperturbative effects. Thus, during this time, Chris also worked to develop basis-spline collocation methods for solving dynamical relativistic fermions in super strong fields. This was perhaps one of the best of times for Chris; on these problems alone, he co-authored fifty articles with more than twenty different collaborators.

24816 (CONF-9411185–5) **TNG calculations and evaluations of photon production data for some ENDF/B-VI materials.** Fu, C.Y. Oak Ridge National Lab., TN (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From NEANC specialist's meeting on measurement, calculation, and evaluation of photon production

data; Bologna (Italy); 9-11 Nov 1994. Order Number DE95014264. Source: OSTI; NTIS; INIS; GPO Dep.

Among the new evaluations in the ENDF/B-VI general purpose files, 25 were based on calculations using TNG, a consistent Hauser-Feshbach pre-equilibrium nuclear model code. The photon production cross sections and spectra were calculated simultaneously with the particle emission cross sections and spectra, assuring energy balance for each reaction. The theories used in TNG for these calculations are summarized. Several examples of photon production data, taken from the ENDF/B-VI files, are compared with the available experimental data.

24817 (JAERI-Research–95-010) **Consistent calculations of fast neutron induced fission, (n,2n) and (n,3n) cross-sections for 71 isotopes of Th, Pa, U, Np, Pu, Am, Cm, Bk and Cf.** Konshin, V.A. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 115p. Order Number DE95789301. Source: OSTI; NTIS; INIS.

The neutron cross-sections for fission, (n,2n) and (n,3n) reactions have been calculated consistently for $^{227-234}$Th, $^{229-233}$Pa, $^{230-240}$U, $^{235-239}$Np, $^{236-247}$Pu, $^{239-245}$Am, $^{238-251}$Cm, $^{245-249}$Bk and $^{249-252}$Cf using the Hauser-Feshbach statistical model code STAPRE. The main parameter of the pre-equilibrium exciton model was tested against the experimental data for the secondary neutron spectra for ^{238}U. Shell, superfluid and collective effects in nuclear level density have been taken into account. Neutron transmission coefficients were calculated using the coupled-channel code ECIS. All experimental data available for fission and (n,2n) reactions for the above isotopes have been used for model testing. Due to a lack of experimental data for the majority of the nuclei considered theoretical prediction of neutron cross-sections has been made. (author).

24818 (JINR-E–4-94-123, pp. 41) **Search for NN-decoupled resonances in the πNN-system.** Bilger, R. (Tuebingen Univ. (Germany)); Clement, H.; Foehl, K.; Heitlinger, K.; Wagner, G.J.; Schepkin, M.; Zaboronsky, O. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 6 refs., 1 fig. RESONANCE PARTICLES/particle production; DIFFERENTIAL CROSS SECTIONS; HELIUM 4 TARGET; IRON 56 TARGET; NUCLEONS; PION MINUS REACTIONS; PION PLUS REACTIONS; PIONS

24819 (JINR-E–4-94-123, pp. 61) **π^+-LI^6 elastic and inelastic scattering.** Eramazhyan, R.A. (AN SSSR, Moscow (Russian Federation). Inst. Yadernykh Issledovanij); Kamalov, S.S.; Ryzhikh, G.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. LITHIUM 6 TARGET/pion plus reactions; ELASTIC SCATTERING; INELASTIC SCATTERING; POLARIZATION-ASYMMETRY RATIO

24820 (JINR-E–4-94-123, pp. 62) **Elastic π^+ scattering on polarized ^{3}He at δresonance energies.** Espy, M. (Kyoto Univ. (Japan)); Dehnhard, D.; Davis, B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. HELIUM 3 TARGET/pion plus reactions; ASYMMETRY; ELASTIC SCATTERING; MEV RANGE 100-1000; POLARIZED TARGETS

24821 (JINR-E–4-94-123, pp. 63) **Pion elastic and inelastic scattering above the δ-resonance.** Takahashi, T. (Kyoto Univ. (Japan)); Sakaguchi, H.; Aoki, K. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. CARBON 12 TARGET/pion reactions; LEAD 208 TARGET/pion reactions; ELASTIC SCATTERING; INELASTIC SCATTERING; MEV RANGE 100-1000

24822 (JINR-E–4-94-123, pp. 72) **Pion momentum spectra in the nuclear charge exchange reactions Mg(t,^{3}He).** Avramenko, S.A. (and others); Aksimenko, V.D.; Anikina, M.Kh. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref. MAGNESIUM/triton reactions; CHARGE-EXCHANGE REACTIONS; GEV RANGE 01-10; HELIUM 3; MAGNESIUM; PIONS

24823 (JINR-E–4-94-123, pp. 79) **Off-shell effects and many-body currents within a gauge independent description of photomeson processes on nuclei.** Levchik, L.G. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Shebeko, A.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 6 refs. PIONS/photoproduction; ALGEBRAIC CURRENTS; MANY-BODY PROBLEM; PHOTONUCLEAR REACTIONS; PIONS; PHOTOPRODUCTION

24824 (JINR-E–4-94-123, pp. 81) **How many nucleons are required for nuclear pion absorption?** Mashnik, S.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 8 refs. PION MINUS REACTIONS/exciton model; PION PLUS REACTIONS/exciton model; MEV RANGE 100-1000; NUCLEAR CASCADES

24825 (LBL–36370) **The dynamics of fragment formation.** Keane, D. (Kent State Univ., OH (United States)). EOS Collaboration. Lawrence Berkeley Lab., CA (United States). Sep 1994. 12p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098 ; FG02-89ER40531 ; FG02-88ER40408 ; FG02-88ER40412 ; FG05-88ER40437. Grant PHY-9123301. (CONF-9409242–3: CORINNE 2: international conference on multiparticles correlation and particle production in nucleus-nucleus collisions, Nantes (France), 5-9 Sep 1994). Order Number DE95011279. Source: OSTI; NTIS; INIS; GPO Dep.

We demonstrate that in the Quantum Molecular Dynamics model, dynamical correlations can result in the production rate for final state nucleon clusters (and hence composite fragments) being higher than would be expected if statistics and the available phase space were dominant in determining composite formation. An intranuclear cascade or a Boltzmann-Uehling-Uhlenbeck model, combined with a statistical approach in the late stage of the collision to determine composites, provides an equivalent description only under limited conditions of centrality and beam energy. We use data on participant fragment production in Au + Au collisions in the Bevalac's BOS time projection chamber to map out the parameter space where statistical clustering provides a good description. In particular, we investigate momentum-space densities of fragments up to ^{4}He as a function of fragment transverse momentum, azimuth relative to the reaction plane, rapidity, multiplicity and beam energy.

24826 (LBL–37201) **Radioisotope yields from 1.85-GeV protons on Mo and 1.85- and 5.0-GeV protons on Te.** Bardayan, D.W. (Tennessee Technological Univ., Cookevill, TN (United States)); Hindi, M.M.; Barghouty, A.F. Lawrence Berkeley Lab., CA (United States); Tennessee Technological Univ., Cookeville, TN (United States). Dept. of Physics. May 1995. 4p. Sponsored by USDOE, Washington, DC (United States);Fundacao de Amparo a Pesquisa do Estado de Sao Paulo (FAPESP), SP (Brazil). DOE Contract AC03-76SF00098 ; FG05-87ER40314. (CONF-9508122–2: 24. international cosmic rays conference (ICRC), Rome (Italy), 28 Aug - 8 sep 1995). Order Number DE95014871. Source: OSTI; NTIS; INIS; GPO Dep.

Radioisotope yields from 1.85-GeV proton interactions in a natural isotopic composition Mo target and those from 1.85- and 5.0-GeV protons in natural Te targets were measured at Lawrence Berkeley Laboratory's Bevatron. The radioisotope yields were determined by γ-counting the targets using a 100-cm^3 coaxial Ge detector following the irradiations. Cross sections were determined for the production of 31 radioactive nuclides, ranging from Z = 35, A = 74, to Z = 43, A = 97, from the Mo target and for 47 radioactive nuclides, ranging from Z = 35, A = 75, to Z = 53, A = 130 from the Te targets.

24827 (SAND–95-1338C) **Further development of the ion cross section for single event upset: model (HICUP).** Connell, L.W.; Sexton, F.W.; Prinja, A.K. Sandia National Labs., Albuquerque, NM (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9507137–1: Institute of Electrical and Electronics Engineers (IEEE) transactions on nuclear science: NSRE conference, Madison, WI (United States), 12 Jul 1995). Order Number DE95014866. Source: OSTI; NTIS; INIS; GPO Dep.

The HICUP models are shown to be useful tools for both analyzing cross section data and performing upset rate calculations, thereby allowing the cross section concept to be used in both areas. The angular dependent HICUP model is developed from the RPP geometry and the Weibull density function. It is compared with angular cross section data, showing good agreement. The HICUP model is used to derive the correct scaling laws for transforming cross section data taken off-normal to normal incidence. The HICUP scaling reconciles two previously proposed inverse cosine scaling corrections which are shown to be asymptotic forms of the HICUP scaling. The angle-integrated form, I-HICUP, is developed and used in Galactic Cosmic Ray (GCR) upset rate calculations on several devices. Results are nearly identical to SPACE RADIATION™ calculations. I-HICUP is used to perform an uncertainty analysis of GCR upset rate, examining the sensitivity to uncertainties in the input parameters. The GCR upset rate shows the greatest sensitivity to upset threshold, device depth (and funnel depth if applicable), and saturation cross section, the least sensitivity to RPP length-to-width aspect ratio. The other Weibull parameters, width, W, and shape, b, are of intermediate sensitivity.

6635 Nuclear Mass Ranges

Refer also to citation(s) 24813, 24814, 24817, 24819, 24820, 24821, 24825, 24826

6636 Radiation Physics

Refer also to citation(s) 24095, 24277, 24279, 24350, 24979, 24982

24828 (DOE/ER/13031–T1) **Nodal methods: An information-based analysis. Final report, September 30, 1990–September 30, 1992.** Nelson, P. Texas A and M Univ., College Station, TX (United States). Texas Engineering Experiment Station. [1992]. 8p. Sponsored by USDOE, Washington, DC (United States);Texas State Government, Austin, TX (United States). DOE Contract FG02-90ER13031. Grant 010366-183. Order Number DE95014929. Source: OSTI; NTIS; GPO Dep.

Purpose is to use information-based complexity to analyze the degree of optimality of nodal methods for both diffusion and (neutron) transport theory, and to compare these methods to finite difference and finite element methods. Results suggest that information-based complexity theory has potential for comparison of alternative spatial approximations in transport theory.

24829 (ENEA-RT-ERG–94-21) **Benchmarking of code MCNPE-BO.** Guaraldi, R. (ENEA, Bologna (Italy). Area Energia Ambiente e Salute); Padoani, F. ENEA, Bologna (Italy). Area Energia Ambiente e Salute. Nov 1994. 37p. Order Number DE95789772. Source: OSTI; NTIS (US Sales Only).

Following the implementation of an electron transport capability based on a new multi-scattering model, underpinned by the Moliere theory, in MCNP, the new code MCNPE-BO was extensively benchmarked by comparison with other codes and particularly with experimental results. Benchmarks were made to assess the response of the code in problems of energy deposition in homogeneous and inhomogeneous media, forward and backward angular distribution, energy spectra, backscattering, interfaces and absorbed dose. Particular importance has been given to the comparison with results from MCNP4, where the electron transport is based on the Goudsmit-Saunderson theory. The conclusion is that MCNPE-BO is a valid aid in dosimetric problems, being robust and reliable in the tested fields. Though MCNPE-BO results are better than MCNP4 results in some fields, the CPU time spent per particle by MCNPE-BO is slightly higher. Work is in progress to overcome this problem.

24830 (LS–165) **Stopping power and scattering angle calculations of charged particle beams through thin foils.** Nassiri, A. Argonne National Lab., IL (United States). Mar 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95015216. Source: OSTI; NTIS; INIS; GPO Dep.

It is important to understand the effects of introducing foils into the path of charged particle beams. In the APS linac system, the intention is to insert thin foils before and after the positron generating target to protect the accelerating structures immediately before and after the target. Electron beams that pass through a dense material lose energy in collisions with the atomic electrons. The scattering path of electrons is much less straight than that of heavier particles (mu, pi meson, K meson, proton, etc.). After a short distance electrons tend to diffuse into the material, rather than proceeding in a rectilinear path.

24831 (SAND–95-1232C) **ITS Version 4.0: Electron/photon Monte Carlo transport codes.** Halbleib, J.A, (Sandia National Labs., Albuquerque, NM (United States)); Kensek, R.P.; Seltzer, S.M. Sandia National Labs., Albuquerque, NM (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951006–4: Winter meeting of the American Nuclear Society, San Francisco, CA (United States), 29 Oct - 1 nov 1995). Order Number DE95013831. Source: OSTI; NTIS; INIS; GPO Dep.

The current publicly released version of the Integrated TIGER Series (ITS), Version 3.0, has been widely distributed both domestically and internationally, and feedback has been very positive. This feedback as well as our own experience have convinced us to upgrade the system in order to honor specific user requests for new features and to implement other new features that will improve the physical accuracy of the system and permit additional variance reduction. This presentation we will focus on components of the upgrade that (1) improve the physical model, (2) provide new and extended capabilities to the three-dimensional combinatorial-geometry (CG) of the ACCEPT codes, and (3) permit significant variance reduction in an important class of radiation effects applications.

24832 (SAND–95-1239C) **Adjoint ITS calculations using the CEPXS electron-photon cross sections.** Lorence, L.J.; Kensek, R.P.; Halbleib, J.A. Sandia National Labs., Albuquerque, NM (United States). [1995]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951006–3: Winter meeting of the American Nuclear Society, San Francisco, CA (United States), 29 Oct - 1 nov 1995). Order Number DE95013832. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. RADIATION TRANSPORT/i codes; MONTE CARLO METHOD; PHOTON TRANSPORT; ELECTRONS; BREMSSTRAHLUNG; RADIATION DOSES; ALUMINIUM; GOLD; CROSS SECTIONS

24833 (WHC-SD-GN-SWD–30005) **MCNP visual editor computer code manual.** Carter, L.L.; Schwarz, R.A. Westinghouse Hanford Co., Richland, WA (United States). 20 Apr 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012582. Source: OSTI; NTIS; GPO Dep.

This document contains the manual for using the Monte Carlo N-Particle (MCNP) Visual Editor.

6640 Atomic and Molecular Physics

Refer also to citation(s) 24805

24834 (LA-SUB–95-90) **Penning trap and resistive cooling of protons. Final technical report, May 1993–March 1995.** Kenefick, R.A. Los Alamos National Lab., NM (United States). [1995]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95014571. Source: OSTI; NTIS; INIS; GPO Dep.

Trapped H^- has been produced from trapped H^+, H_2^+, and H_3^+ in an ICR trap. The initial positive ions collide with a cesiated trap surface and are recaptured as H^- by fast reversal of the trapping potential.

6641 Theory of Electronic Structure of Atoms and Molecules

24835 (UCRL-JC–117020) **Inner-shell photo-ionized X-ray laser schemes for low-Z elements.** Moon, S.J. (Lawrence Livermore National Lab., CA (United States)); Eder, D.C.; Strobel, G.L. Lawrence Livermore National Lab., CA (United States). 21 Oct 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940592–13: 4. international colloquium on X-ray lasers, Williamsburg, VA (United States), 16-20 May 1994). Order Number DE95014697. Source: OSTI; NTIS; INIS; GPO Dep.

Gain calculations for inner-shell photo-ionized lasing in C at 45 Å are performed. An incident x-ray source represented by a 150 eV blackbody with a rise time of 50 fsec gives a gain of order 10 cm^{-1}. The x-ray source and thus the driving optical laser requirements are significantly reduced as compared to what is needed for Ne at 15 Å. The authors expect that existing ultra-short pulse lasers can produce the required x-ray source and thus produce a table-top x-ray laser at 45 Å.

6642 Spectra of Atoms and Molecules and Their Interactions With Photons

Refer also to citation(s) 23940

24836 (BNL–61928) **Quantum phase space theory for the calculation of v·j vector correlations.** Hall, G.E. (Brookhaven National Lab., Upton, NY (United States). Dept. of Chemistry). Brookhaven National Lab., Upton, NY (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-950793–5: 40. annual meeting of the Society of Photo-Optical Instrumentation Engineers: international symposium on optical science, engineering and instrumentation, San Diego, CA (United States), 9-14 Jul 1995). Order Number DE95014450. Source: OSTI; NTIS; INIS; GPO Dep.

The quantum state-counting phase space theory commonly used to describe barrierless dissociation is recast in a helicity basis to calculate photofragment v·j correlations. Counting pairs of fragment states with specific angular momentum projection numbers on the relative velocity provides a simple connection between angular momentum conservation and the v·j correlation, which is not so evident in the conventional basis for phase space state counts. The upper bound on the orbital angular momentum, l, imposed by the centrifugal barrier cannot be included simply in the helicity basis, where l is not a good quantum number. Two approaches for a quantum calculation of the v·j correlation are described to address this point. An application to the photodissociation of NCCN is consistent with recent classical phase space calculations of Cline and Klippenstein. The observed vector correlation exceeds the phase space theory prediction. The authors take this as evidence of incomplete mixing of the K states of the linear parent molecule at the transition state, corresponding to an evolution of the body-fixed projection number K into the total helicity of the fragment pair state. The average over a thermal distribution of parent angular momentum in the special case of a linear molecule does not significantly reduce the v·j correlation below that computed for total J = 0.

24837 (DOE/ER/14402–7) **Spectroscopy at metal cluster surfaces. Annual report, Year 2.** Duncan, M.A. Georgia Univ., Athens, GA (United States). Dept. of Chemistry. [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-93ER14402. Order Number DE95015513. Source: OSTI; NTIS; INIS; GPO Dep.

The focus of our research program is the study of gas phase metal clusters to evaluate their potential to model fundamental interactions present on metal surfaces. To do this, we characterize the chemical bonding present between the component atoms in metal clusters as well as the bonding exhibited by "physisorption" on cluster surfaces. Electronic spectra, vibrational frequencies and bond neutral and ionized clusters with a variety of laser/mass spectrometry techniques. We are particularly interested in bimetallic cluster systems, and how their properties compare to those of corresponding pure metal clusters.

6643 Collision Phenomena

Refer also to citation(s) 23841, 23954, 24830

24838 (ANL/ER/PP–81214) **Electron energy spectra of H^- autodetaching states resulting from collisions of H^- with He at 1 keV.** Kimura, M. (Argonne National Lab., IL (United States)); Sato, H.; Hino, K.; Matsuzawa, M. Argonne National Lab., IL (United States). [1995]. 13p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Japan Society for the Promotion of Science, Tokyo (Japan). DOE Contract W-31-109-ENG-38. Order Number DE95013494. Source: OSTI; NTIS; GPO Dep.

Electron energy spectra for H^- autodetaching states resulting from collisions H^- with He at 1 keV are rigorously calculated by including couplings between doubly excited states and continuum states and their interference with direct detachment processes. An energy sampling procedure, based on the Gauss quadratures, is used to discretize continuum states. The present theoretical result, for the first time, clarifies mechanisms of excitation to doubly excited states, quantitatively reproduces the experimental spectra first observed by Risley and Geballe in 1974, separates the contributions from each of three autodetaching states, and identifies the cause of the interference between autodetaching and direct-detaching excitation channels.

24839 (DOE/ER/13937–7) **Laser enhanced chemical reaction studies. Technical report, January 1, 1994–February 28, 1995.** Columbia Univ., New York, NY (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER13937. Order Number DE95014540. Source: OSTI; NTIS; GPO Dep.

The relaxation of vibrationally excited pyrazine (E=40,640 cm^{-1}) by collisions which populate the high J tail (J=58-82) of the vibrationless ground state (00^00) of CO_2 has been studied using tunable infrared diode lasers to probe the scattered CO_2 molecules. The nascent rotational populations and translational recoil velocities for a series of rotational states in the high J tail of the 00^00 level of CO_2 were measured at five collision cell temperatures: 243, 263, 298, 339, and 364 K. Both the rate constants describing these V-R/T processes and the translational temperatures describing the recoiling CO_2 molecules exhibit a very weak positive temperature dependence indicating that the high energy CO_2 molecules must originate from near the center of the pre-collision energy distribution. Quantitative estimates of the actual amount of energy transferred in collisions between CO_2 and vibrationally excited

pyrazine, based on an angular momentum and translational energy exponential gap model of the cross section, indicate that ΔE_{total} can be as large as 7090 cm^{-1} (~20 kcal/mol). These experiments offer compelling evidence that these energy transfer events can indeed be classified as supercollisions since they involve unusually large, single collision energy transfer magnitudes; and despite their relative infrequency, they play a most important role in the collisional deactivation of vibrationally excited pyrazine by a CO_2 bath.

24840 (JINR-E–4-94-123, pp. 58) **Collisions of negative muons and hadrons with metastable atoms.** Korenman, G.Ya. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Lhagva, O. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. HELIUM/muon-atom collisions; HYDROGEN/muon-atom collisions; CROSS SECTIONS; HELIUM; HYDROGEN; METASTABLE STATES

6644 Experimentally Derived Information On Atomic and Molecular Properties

Refer also to citation(s) 24838

6645 Special Atoms and Molecules

24841 (JINR-E–4-94-123, pp. 54) **Theoretical description of the lightest pionic atoms.** Cieply, A.; Mach, R. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. PIONIC ATOMS/helium 3; HYDROGEN ISOTOPES; NUCLEAR POTENTIAL; PHOTONS

24842 (JINR-E–4-94-123, pp. 55) **General formula for the coalescence model and an evidence of non-existence of Z=-1 pi-neuts.** Hirenzaki, S.; Suzuki, T.; Tanihata, I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 5 refs. PIONIC ATOMS/pions neutral; COMPOSITE MODELS; NEUTRONS

24843 (JINR-E–4-94-123, pp. 56) **Formation of deeply bound pionic atoms.** Hirenzaki, S.; Toki, H. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. PIONIC ATOMS; DEUTERON REACTIONS; HELIUM 3; LEAD 208 TARGET; MEV RANGE 100-1000

24844 (JINR-E–4-94-123, pp. 57) **Theoretical problems of hadronic atom metastable states.** Korenman, G.Ya. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 8 refs. HADRONIC ATOMS/metastable states; HELIUM

24845 (JINR-E–4-94-123, pp. 59) **Microscopic kaonic atom optical potential in finite nuclei with λ(1405) and σ(1385).** Mizoguchi, M.; Hirenzaki, S.; Tpki, H. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. KAONIC ATOMS/potentials; POTENTIALS; LAMBDA-1405 BARYONS; NUCLEI; SIGMA-1385 BARYONS

24846 (JINR-E–4-94-123, pp. 60) **Metastable states of antiprotonic helium atoms.** Tsookhuu, Kh.; Orlokh, D. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1994. 126p. (CONF-9405202–: Mesons and nuclei at intermediate energies, Dubna (Russian Federation), 3-7 May 1994). In *Mesons and nuclei at intermediate energies. International conference. Book of abstracts.* Order Number DE95633649. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 8 refs. HADRONIC ATOMS/metastable states; ANTIPROTONS; LIFETIME

6650 Physics of Condensed Matter

Refer also to citation(s) 23466, 23467, 23471, 23902, 24837, 24858

24847 (DOE/ER/25181–T1) **Immersed interface methods. Progress report.** LeVeque, R.J.; Adams, L.M.; Bube, K.P. Washington Univ., Seattle, WA (United States). Apr 1995. 9p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract FG06-93ER25181. Grant DMS-9303404. Order Number DE95012412. Source: OSTI; NTIS; GPO Dep.

Considerable progress has been made on several problems mentioned in the original proposal and in last year's progress report. Our work is also going in some new directions. The primary focus is still on Immersed Interface Methods (IIM's) for high order accuracy of interface problems on Cartesian grids, but the investigators have also been involved in other projects. In particular, LeVeque's work on clawpack described below has been supported in part by these grants and has been used in direct connection with IIM's in projects in both groundwater flow and acoustics.

24848 (LBL-PUB–754, pp. 203-210) **Simple surface structure determination from Fourier transforms of angle-resolved photoemission extended fine structure.** Zheng, Y. (Pennsylvania State Univ., University Park, PA (United States)); Shirley, D.A. Lawrence Berkeley Lab., CA (United States). Feb 1995. DOE Contract AC03-76SF00098. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

The authors show by Fourier analyses of experimental data, with no further treatment, that the positions of all the strong peaks in Fourier transforms of angle-resolved photoemission extended fine structure (ARPEFS) from adsorbed surfaces can be explicitly predicted from a trial structure with an accuracy of about $\pm$ 0.3 Å based on a single-scattering cluster model together with the concept of a strong backscattering cone, and without any additional analysis. This characteristic of ARPEFS Fourier transforms can be developed as a simple method for determining the structures of adsorbed surfaces to an accuracy of about $\pm$ 0.1 Å.

24849 (SAND–95-1201) **Trapping of radiation in plasmas.** Riley, M.E.; Alford, W.J. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015062. Source: OSTI; NTIS; GPO Dep.

The authors analyze the problem of radiation trapping (imprisonment) by the method of Holstein. The process is described by an integrodifferential equation which shows that the effective radiative decay rate of the system depends on the size and the shape of the active medium. Holstein obtains a global decay rate for a particular

geometry by assuming that the radiating excited species evolves into a steady state spatial mode. The authors derive a new approximation for the trapped decay which has a space dependent decay rate and is easy to implement in a detailed computer simulation of a plasma confined within an arbitrary geometry. They analyze the line shapes that are relevant to a near-atmospheric-pressure mixture of He and Xe. This line-shape analysis can be utilized in either the Holstein formulae or the space-dependent decay approximation.

24850 (UCRL-JC–115959) **Laser-induced fluorescence diagnostic for the LEM turbulent hydrodynamics experiment.** Remington, B.; Dimonte, G. Lawrence Livermore National Lab., CA (United States). Dec 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941174–1: Meeting of the Fluid Dynamics Division of the American Physical Society, Atlanta, GA (United States), 20-22 Nov 1994). Order Number DE95014698. Source: OSTI; NTIS; INIS; GPO Dep.

The authors are developing a laser-induced fluorescence (LIF) diagnostic for the LEM experiment to measure the evolution of a Rayleigh-Taylor unstable fluid interface into the highly nonlinear regime. The interface will be between two fluids of different density in a 7 x 7 x 14 cm cell that will be accelerated downwards over a distance of ~100 cm, achieving maximum velocities of order 50 m/s. One of the two fluids will be doped with laser dye and pumped to fluoresce with a 100 Hz pulsed, frequency doubled YAG laser beam spread into a sheet and entering the cell from the bottom. The short pulse duration of the laser (<10 ns) eliminates motional blurring, and the images are recorded from the side with a series of 35 mm static cameras. Aligning the laser sheet to the center of the cell localizes the region of the cell probed and eliminates edge effects in the data. This LIF diagnostic will be described.

6651 Nuclear Techniques in Condensed Matter Physics

Refer also to citation(s) 23881, 24062, 24985

24851 (CONF-9408180–3) **β-Decay probing the electron bulk correlations.** Kondratyev, V.N. (INFN, Catania (Italy). Lab. Nazionale del Sud); Ayik, S. Tennessee Technological Univ., Cookeville, TN (United States). Dept. of Physics. [1994]. 6p. Sponsored by USDOE, Washington, DC (United States);Istituto Nazionale di Fisica Nucleare, Rome (Italy). DOE Contract FG05-89ER40530. From 4. KINR international school on nuclear physics; Kiev (Ukraine); 29 Aug - 7 sep 1994. Order Number DE95013489. Source: OSTI; NTIS; INIS; GPO Dep.

The theoretical approach based on the Boltzman-Langevin model is applied to study the thermal properties of the excitation phenomena in condensed matter. This approach making use of the advantages of the thermodynamic Green's function method provides a tool for the self-consistent description of the many-body correlations. It is demonstrated that such a correlation modifies significantly the excitation strength properties of the electron gas. The resonant thermal effects in electron bulk excitation accompanying a radioactive decay in solids are discussed.

24852 (SAND–94-2468C) **Energy dispersive X-ray reflectivity characterization of semiconductor heterostructures and interfaces.** Chason, E. (Sandia National Labs., Albuquerque, NM (United States)); Mayer, T.M.; Krstelj, Z.M. Sandia National Labs., Albuquerque, NM (United States). [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950117–5: Workshop on semiconductor characterization, Gaithersburg, MD (United States), 30 Jan - 2 feb 1995). Order Number DE95014603. Source: OSTI; NTIS; GPO Dep.

Energy dispersive X-ray reflectivity is a versatile tool for analyzing thin film structures. Layer thickness, interface roughness and composition can be determined with a single non-destructive measurement. Use of energy dispersive detection enables spectra to be acquired in less than 500 s with a rotating anode X-ray generator, making the study of kinetics possible.

6653 Interactions Between Beams and Condensed Matter

Refer also to citation(s) 23842, 23896, 23963

24853 (ANL/CHM/CP–84380) **Pulsed ion beam methods for in situ characterization of diamond film deposition processes.** Krauss, A.R. (Argonne National Lab., IL (United States)); Smentkowski, V.S.; Zuiker, C.D.; Gruen, D.M.; Im, J.; Schultz, J.A.; Waters, K.; Chang, R.P.H. Argonne National Lab., IL (United States). [1995]. 22p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Contract DAAL 03-92-C-0002. (CONF-950454–4: 22. international AVS conference on metallurgical coatings and thin films, San Diego, CA (United States), 24-28 Apr 1995). Order Number DE95012275. Source: OSTI; NTIS; GPO Dep.

Diamond and diamond-like carbon (DLC) have properties which in principle make them ideally suited to a wide variety of thin-film applications. Their widespread use as thin films, however, has been limited for a number of reasons related largely to the lack of understanding and control of the nucleation and growth processes. Real-time, in situ studies of the surface of the growing diamond film are experimentally difficult because these films are normally grown under a relatively high pressure of hydrogen, and conventional surface analytical methods require an ultrahigh vacuum environment. It is believed, however, that the presence of hydrogen during growth is necessary to stabilize the corrugated diamond surface structure and thereby prevent the formation of the graphitic phase. Pulsed ion beam-based analytical methods with differentially pumped ion sources and particle detectors are able to characterize the uppermost atomic layer of a film during growth at ambient pressures 5-7 orders of magnitude higher than other surface-specific analytical methods. We describe here a system which has been developed for the purpose of determining the hydrogen concentration and bonding sites on diamond surfaces as a function of sample temperature and ambient hydrogen pressure under hot filament CVD growth conditions. It is demonstrated that as the hydrogen partial pressure increases, the saturation hydrogen coverage of the surface of a CVD diamond film increases, but that the saturation level depends on the atomic hydrogen concentration and substrate temperature.

24854 (ANL/CHM/CP–86330) **Femtosecond laser postionization of sputtered and laser desorbed atoms.** Pellin, M.J.; Lykke, K.R.; Calaway, W.F. Argonne National Lab., IL (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9504169–1: 4. international workshop on postionization techniques in surface analysis (PITSA), Burgenland (Austria), 23-27 Apr 1995). Order Number DE95012273. Source: OSTI; NTIS; GPO Dep.

This paper examines the photoionization efficiency of a femtosecond laser ionization source on several atomic species. Use of femtosecond laser ionization pulses to photoionize the desorbing flux from a sample surface is examined. Example of mass spectra produced is given using 248 nm pulse on sputtered Au. Al and Mo have widely different ionization potentials and show that 248 nm pulses are more efficient at photoionization than longer wavelengths; this is enhanced for Mo with high ionization potential. It is concluded that efficient photoionization occurs for atoms with ionization potentials low enough for two-photon ionization to occur.

6654 Quantum Physics Aspects of Condensed Matter

665410 Superconductivity

Refer also to citation(s) 23665, 23894, 24239, 24243, 24297

24855 (ANL/MSD/CP–82694) **Paramagnetism and reentrant behavior in quasi-1D superconductors at high magnetic fields.** Se de Melo, C.A.R. Argonne National Lab., IL (United States). Apr 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505186–3: 2. physical phenomena at high magnetic fields conference, Tallahassee, FL

(United States), 6-9 May 1995). Order Number DE95013755. Source: OSTI; NTIS; INIS; GPO Dep.

The thermodynamics of quasi-one-dimensional superconductors in the presence of large magnetic fields is studied. When the quantum effects of the magnetic field are taken into account, several reentrant phases persist at very high fields. In the last reentrant phase, the free energy, the specific heat jump and the excess magnetization are estimated near the critical temperature. In particular, the excess magnetization is found to be paramagnetic as opposed to diamagnetic (in weak fields) and its sign is found to be controlled by the slope of H_{c2}. This result is further generalized to the entire phase diagram (including all quantum phases) and to different physical systems using general thermodynamic relations which show that the sign of the excess magnetization ΔM near $H_{c2}(T)$ follows $dH_{c2}(T)/dT$. These relations provide a scenario for the evolution of the sign of ΔM from weak fields to strong fields.

24856 (CONF-941013–49) **Performance of pancake coils of parallel co-wound Ag/BSCCO tape conductors in static and ramped magnetic fields.** Schwenterly, S.W. (Oak Ridge National Lab., TN (United States)); Lue, J.W.; Lubell, M.S.; Walker, M.S.; Hazelton, D.W.; Haldar, P.; Rice, J.A.; Hoehn, J.G. Jr.; Motowidlo, L.R. Oak Ridge National Lab., TN (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Applied superconductivity conference; Boston, MA (United States); 16-21 Oct 1994. Order Number DE95013045. Source: OSTI; NTIS; INIS; GPO Dep.

Critical Currents are reported for several Ag/BSCCO single-pancake coils in static magnetic fields ranging from 0 to 5 T and temperatures from 4.2 K to 105 K. The sample coils were co-wound of one to six tape conductors in parallel. Since the closed loops formed in such an arrangement could lead to eddy current heating or instability in changing fields, one of the coils was also tested in helium gas, in fields ramped at rates of up to 1.5 T/s. For these quasi-adiabatic tests, at each temperature the transport current was set just below the critical value for a preset static field of 3.3 or 4.9 T. The field was then rapidly ramped down to zero, held for 20 sec, and then ramped back up to the original value. The maximum observed temperature transient of about 1.7 K occurred at 9 K, for a field change of 4.75 T. The temperature transients became negligible when the sample was immersed in liquid helium. Above 30 K, the transients were below 1 K. These results give confidence that parallel co-wound HTSC coils are stable in a rapidly-ramped magnetic field, without undue eddy current heating.

24857 **Epitaxial $SrRuO_3$ films.** Wu, Xin Di; Muenchausen, R. 1993. Filed date 2 Apr 1993. U.S. Patent Application 8-042,209. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95015104. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Disclosed is an epitaxial oriented thin film of an alkaline earth metallic oxide selected from $SrRuO_3$, $CaRuO_3$, $BaRuO_3$, or mixed alkaline earth ruthenium trioxides thereof is provided. A S-N-S junction device including a substrate, a first portion of a superconducting copper oxide in contact with the substrate, a portion of an alkaline earth metallic oxide in contact with the first portion of a superconducting copper oxide, and, a second portion of a superconducting copper oxide in contact with the portion of an alkaline earth metallic oxide, but separated from the first portion of superconducting copper oxide is also provided as well as a ferroelectric device including a substrate, a first portion of an alkaline earth metallic oxide upon the substrate, a portion of a ferroelectric material upon the first portion of an alkaline earth metallic oxide, and, a portion of a conductive material of a material selected from the group consisting of platinum metal or an alkaline earth metallic oxide upon the portion of ferroelectric material. Finally, an improvement in a process for the preparation of an electronic component including deposition of a first material portion, deposition of a patterned second material portion upon the first material portion, said second material portion chemically resistant to subsequent chemical etching by a dilute acid, and subsequent chemical etching by a dilute acid of the first material portion uncovered by the patterned second material portion, wherein the improvement includes using an alkaline earth metallic oxide selected from the group consisting of $SrRuO_3$, $CaRuO_3$, $BaRuO_3$, or mixed alkaline earth ruthenium trioxides thereof as the second material portion chemically resistant to subsequent chemical etching by a dilute acid is provided.

70 PLASMA PHYSICS AND FUSION

24858 (DOE/SF/19460–58) **LLE review. Volume 61, Quarterly report, October–December 1994.** Rochester Univ., NY (United States). Lab. for Laser Energetics. [1994]. 58p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract FC03-92SF19460. Contract DAAL03-92-G-0147. Order Number DE95012914. Source: OSTI; NTIS; INIS; GPO Dep.

This volume of the LLE review, covering the period of October–December 1994, contains articles on a diagnostic method employing krypton spectroscopy for measurement of temperature and shell-fuel mixing in high-temperature implosions; the first direct assessment of the ion-acoustic decay instability in a large-scale length, hot plasma; measurements of polarization mode dispersion and group-velocity walkaway in birefringent media using a frequency domain interferometer; an evaluation of the magnetic flux dynamics occurring in an optically triggered, thin-film superconducting switch; the effect of slurry fluid chemistry on particle size distribution during aqueous polishing of optical glass; and the influence of thermal and mechanical processing history in the preparation of well-ordered liquid crystal elastomer systems.

7003 Plasma Physics and Fusion Research

Refer also to citation(s) 24892

24859 (CONF-9505105–6) **Fast wave current drive modeling using the combined RANT3D and PICES codes.** Jaeger, E.F. (and others); Murakami, M.; Stallings, D.C. Oak Ridge National Lab., TN (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC03-89ER51114 ; FG03-86ER53225. From 11. topical conference on radio frequency in plasmas; Palm Springs, CA (United States); 17-19 May 1995. Order Number DE95014592. Source: OSTI; NTIS; INIS; GPO Dep.

Two numerical codes are combined to give a theoretical estimate of the current drive and direct electron heating by fast waves launched from phased antenna arrays on the DIII-D tokamak. Results are compared with experiment.

24860 (DOE/ER/53198–261) **High current plasma electron emitter.** Fiksel, G. (and others); Almagri, A.F.; Craig, D. Wisconsin Univ., Madison, WI (United States). Plasma Physics Research. Jul 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER53198. Order Number DE95015953. Source: OSTI; NTIS; INIS; GPO Dep.

A high current plasma electron emitter based on a miniature plasma source has been developed. The emitting plasma is created by a pulsed high current gas discharge. The electron emission current is 1 kA at 300 V at the pulse duration of 10 ms. The prototype injector described in this paper will be used for a 20 kA electrostatic current injection experiment in the Madison Symmetric Torus (MST) reversed-field pinch. The source will be replicated in order to attain this total current requirement. The source has a simple design and has proven very reliable in operation. A high emission current, small size (3.7 cm in diameter), and low impurity generation make the source suitable for a variety of fusion and technological applications.

24861 (DOE/ER/53299–1) **Impurity transport theory for text and ASDEX tokamak. Final report, September 25, 1989–November 24, 1990.** Sigmar, D.J. Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center. [1995]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER53299. Order Number DE95013813. Source: OSTI; NTIS; INIS; GPO Dep.

Progress is reported in the following areas of plasma research: impurity and transport, neoclassical losses of fusion-produced energetic particles, and plasma turbulence.

24862 (DOE/ER/54241–2) **Texas Experimental Tokamak, a plasma research facility: Technical progress report.** Wootton, A.J. Texas Univ., Austin, TX (United States). Fusion Research Center. Aug 1995. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-94ER54241. Order Number DE95016229. Source: OSTI; NTIS; INIS; GPO Dep.

In the year just past, the authors made major progress in understanding turbulence and transport in both core and edge. Development of the capability for turbulence measurements throughout the poloidal cross section and intelligent consideration of the observed asymmetries, played a critical role in this work. In their confinement studies, a limited plasma with strong, H-mode-like characteristics serendipitously appeared and received extensive study though a diverted H-mode remains elusive. In the plasma edge, they appear to be close to isolating a turbulence drive mechanism. These are major advances of benefit to the community at large, and they followed from incremental improvements in diagnostics, in the interpretation of the diagnostics, and in TEXT itself. Their general philosophy is that the understanding of plasma physics must be part of any intelligent fusion program, and that basic experimental research is the most important part of any such program. The work here demonstrates a continuing dedication to the problems of plasma transport which continue to plague the community and are an impediment to the design of future devices. They expect to show here that they approach this problem consistently, systematically, and effectively.

24863 (DOE/ET/53088–701) **Revisit to self-organization of solitons for dissipative Korteweg-de Vries equation.** Kondoh, Y.; Van Dam, J.W. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Mar 1995. 15p. Sponsored by USDOE, Washington, DC (United States);JIFT Program (United States). DOE Contract FG05-80ET53088. (IFSR–701). Order Number DE95009556. Source: OSTI; NTIS; INIS; GPO Dep.

The process by which self-organization occurs for solitons described by the Korteweg-de Vries (KdV) equation with a viscous dissipation term is reinvestigated theoretically, with the use of numerical simulations in a periodic system. It is shown that, during nonlinear interactions, two basic processes for the self-organization of solitons are energy transfer and selective dissipation among the eigenmodes of the dissipative operator. It is also clarified that an important process during nonlinear self-organization is an interchange between the dominant operators, which has hitherto been overlooked in conventional self-organization theories and which leads to a final self-similar coherent structure determined uniquely by the dissipative operator.

24864 (GA-A–22048) **Experimentally determined profiles of fast wave current drive on DIII-D.** Forest, C.B. (General Atomics, San Diego, CA (United States)); Petty, C.C.; Baity, F.W. General Atomics, San Diego, CA (United States); Oak Ridge National Lab., TN (United States); Lawrence Livermore National Lab., CA (United States). Jun 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114 ; AC05-84OR21400 ; W-7405-ENG-48. (CONF-9505105–3: 11. topical conference on radio frequency in plasmas, Palm Springs, CA (United States), 17-19 May 1995). Order Number DE95015359. Source: OSTI; NTIS; INIS; GPO Dep.

Profiles of non-inductive current driven by fast waves have been determined for reversed-shear DIII-D discharges. Both the current profile and toroidal electric field profile are determined from time sequences of equilibrium reconstructions. Using this information, the measured current profile has been separated into inductive and non-inductive portions. By comparing similar fast wave power, the portion of the total non-inductive current driven by fast waves were determined. The experimentally determined profiles of FWCD are in general agreement with theoretical predictions. Specifically, 135 kA was driven by 1.4 MW of rf power with a profile peaked inside $\rho = 2$.

24865 (GA-A–22062) **Interaction of fast waves with ions.** Chiu, S.C. (and others); deGrassie, J.S.; Harvey, R.W. General Atomics, San Diego, CA (United States). Jun 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114. (CONF-9505105–1: 11. topical conference on radio frequency in plasmas, Palm Springs, CA (United States), 17-19 May 1995). Order Number DE95014669. Source: OSTI; NTIS; INIS; GPO Dep.

To fully utilize the available power sources in DIII-D (FW, NBI, ECH), understanding of the synergism between the heating mechanisms is important. In this paper the ion distribution, under simultaneous application of NBI and FW, is calculated from Fokker-Planck code CQL3D coupled to ray-tracing code CURRAY. It is found that interaction between energetic ions and FW can be minimized or maximized by adjusting various parameters such as magnetic field, density, beam energy, and FW frequency. Specifically, in DIII-D, the authors find negligible interactions above 1.8 T and above 80 MHz, while the interaction increases at lower fields and frequencies. The results are compared with experiments in DIII-D including the calculated neutron rate. Energetic ion orbit losses may play an important role in the ion distribution, and this effect is being investigated.

24866 (JAERI-Review–95-003) **Review of 'cold fusion'.** Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 98p. (In Japanese). Order Number DE95789285. Source: OSTI; NTIS; INIS.

This review describes the results from the following works: (1) to overview the chronological history of 'cold fusion' including the International Conferences on cold fusion (ICCF-3 and ICCF-4), (2) to overview the various theories which can explain the 'cold fusion' phenomena, (3) to overview the current status of the experiments to produce anomalous excess heat by electrolysis with palladium electrodes, (4) to explain the excess heat phenomena on the basis of chemical heat in hydrogen dissolution to palladium alloys, (5) to check the possibility of multi-body fusion reactions in hydrogen-absorbed palladium alloys, and (6) to overview newly-proposed ideas to realize nuclear fusion in smaller devices than the magnetic or laser fusion devices. JAERI presented a view that 'cold fusion' using electrolysis with palladium electrodes seemed to show no evidence of nuclear fusion, in the journal of 'Genshiryoku-Kogyo (in Japanese)'. As a result from this review, JAERI confirms to reach almost the same conclusion as the previously-stated view, while the ideas or experiments to achieve nuclear fusion without contradiction against the knowledge of physics and using small-scale devices should be encouraged. (author) 195 refs.

24867 (NIFS–329) **A model of sawtooth based on the transport catastrophe.** Itoh, K.; Itoh, S.; Fukuyama, A. National Inst. for Fusion Science, Nagoya (Japan). Dec 1994. 26p. Order Number DE95789307. Source: OSTI; NTIS; INIS.

A new model of the sawtooth, which is not triggered by the m=1 helical mode, is proposed. The catastrophic change of the transport coefficient is predicted in the central region, where the safety factor q is lower than unity. The magnetic component in fluctuation increases as the plasma pressure increases. If the pressure gradient exceeds a certain threshold, a magnetic stochasticity sets in. The electron thermal conductivity can be enhanced by the factor of the ion-to-electron mass ratio, leading to the rapid flattening of the electron pressure profile. The enhanced transport coefficient also happens for ions. The increment of the transport associated with the strong magnetic perturbation continues until the ion pressure profile is flattened. Hysteresis behaviour of transport flux to the pressure gradient is obtained. The current profile is influenced by the enhanced current diffusivity from the same mechanism, but the change of the q profile remains small. Simple model equations which follow the dynamics are introduced. The dynamic solution of sawtooth crash is simulated. (author).

24868 (NIFS–330) **Launching conditions for electron cyclotron heating in a sheared magnetic field.** Nagasaki, K. (Kyoto Univ., Uji (Japan). Plasma Physics Lab.); Ejiri, A. National Inst. for Fusion Science, Nagoya (Japan). Jan 1995. 22p. Order Number DE95789308. Source: OSTI; NTIS; INIS.

Launching conditions for an electron cyclotron wave in a plasma with a sheared magnetic field are studied. One dimensional second order coupled equations are solved for the ordinary and extraordinary modes. It is shown that for wave absorption, the rotation angle and ellipticity of the wave should be determined by taking into account the effect of the sheared magnetic field, particularly in heliotron/torsatron configurations. Launching conditions for effective

heating are obtained for second harmonic extraordinary-mode heating in the Heliotron-E, CHS and LHD helical devices. (author).

24869 (NIFS–331) **An advanced electrostatic particle simulation algorithm for implicit time integration.** Watanabe, T.H.; Todo, Y.; Horiuchi, R.; Watanabe, K.; Sato, T. National Inst. for Fusion Science, Nagoya (Japan). Jan 1995. 29p. Order Number DE95789312. Source: OSTI; NTIS; INIS.

We have developed an advanced electrostatic macro-scale implicit particle simulation code (AMACS-ES), which enables us to simulate low-frequency plasma wave phenomena with large spatial scale length. Especially, the Poisson's equation with the implicit susceptibility term is accurately solved in our algorithm. Linear properties of the simulation code based on this algorithm, such as the linear stability and the dispersion relation, are examined. We have also applied our simulation code to the excitation and nonlinear saturation of the ion temperature gradient (ITG) drift instability in a system with a shearless slab geometry. The linear properties of the excited ITG mode are compared with the theoretical prediction to find a good agreement. (author).

24870 (NIFS–332) **Bifurcations from periodic solution in a simplified model of two-dimensional magnetoconvection.** Bekki, N. (Nihon Univ., Koriyama, Fukushima (Japan). Coll. of Engineering); Karakisawa, T. National Inst. for Fusion Science, Nagoya (Japan). Jan 1995. 84p. Order Number DE95789306. Source: OSTI; NTIS; INIS.

We study a two-dimensional Boussinesq fluid with the nonlinear interaction between the Rayleigh-Benard convection and an externally imposed magnetic field. We introduce a simplified model of fifth-order system of nonlinear ordinary differential equations with five parameters and integrate it numerically in some parameter regions. We find various types of bifurcations from periodic solutions: period-doubling bifurcation, heteroclinic bifurcation, intermittency and abnormal transition to chaos. We also derive a normal form equation from our fifth-order system, applying the center manifold theory to it, and give an expression for the renormalized Holmes-Melnikov boundary to evaluate numerical results. By means of the normal form equation, we show that each property of the two phase portraits described by the Duffing equation and the van der Pol equation emanates from one common attractor in the five-dimensional space of the fifth-order system. (author).

24871 (NIFS–333) **Theory of anomalous transport in reverse field pinch.** Itoh, K.; Itoh, S.; Yagi, M.; Fukuyama, A. National Inst. for Fusion Science, Nagoya (Japan). Jan 1995. 16p. Order Number DE95789309. Source: OSTI; NTIS; INIS.

The transport coefficient for the magnetized plasma, which has been obtained by use of the method of self-sustained turbulence, is applied to the reverse field pinch (RFP). The dependence $\beta_p \propto n^{3/4}/I_p$ is obtained (β_p: plasma pressure divided by the poloidal magnetic pressure, n: plasma density and I_p: plasma current). This result gives an explanation of the experimental observation of the RFP scaling, $\beta_p \propto n/I_p$. The theory of anomalous transport unifies the L-mode scaling laws in the tokamaks, stellarators and heliotron/torsatron as well as RFP. (author).

24872 (NIFS–334) **Application of grating polarizer to 106.4GHz ECH system on Heliotron-E.** Nagasaki, K. (Kyoto Univ., Uji (Japan). Plasma Physics Lab.); Isayama, A.; Ejiri, A. National Inst. for Fusion Science, Nagoya (Japan). Jan 1995. 31p. Order Number DE95789310. Source: OSTI; NTIS; INIS.

A grating polarizer with rectangular grooves is designed for 106.4GHz electron cyclotron heating (ECH) system on the Heliotron-E helical device. The polarizer is installed on mirrors of waveguide miter bends. In oversized waveguides, the HE_{11} mode can be treated by the plane wave theory. The polarization of the reflected wave is calculated as a function of the groove parameters and the mirror rotation angle. When launching the ECH power to fusion devices with moderate or strong magnetic shear such as heliotron/torsatron configurations, we should take into account the change of the wave polarization through the plasma. The effect of the magnetic shear can be investigated by using the polarizer. The dependence of the absorbed power on the mirror rotation angle are presented. (author).

24873 (NIFS–335) **A self-consistent open boundary model for particle simulation in plasmas.** Takamaru, H.; Sato, T.; Horiuchi, R.; Watanabe, K. National Inst. for Fusion Science, Nagoya (Japan). Feb 1995. 20p. Order Number DE95789311. Source: OSTI; NTIS; INIS.

A particle simulation model with open boundary, applicable to a system in which the internal plasma contacts with an external plasma source such as a current generator, is developed. We present this formalism and examine the range of applicability of this procedure. This scheme assures a balance between the outgoing and incoming particle fluxes through the boundaries at each time step. The numerical code developed on this principle is applied to an ion acoustic double layer under the condition that the system is connected to a constant current generator to confirm the soundness and viability of the code. (author).

24874 (PPPL–3011-R) **Collisional stochastic ripple diffusion of alpha particles and beam ions on TFTR.** Redi, M.H.; Zarnstorff, M.C.; White, R.B.; Budny, R.V.; Janos, A.C.; Owens, D.K.; Schivell, J.F.; Scott, S.D.; Zweben, S.J. Princeton Univ., NJ (United States). Plasma Physics Lab. Jul 1995. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE95016245. Source: OSTI; NTIS; INIS; GPO Dep.

Predictions for ripple loss of fast ions from TFTR are investigated with a guiding center code including both collisional and ripple effects. A synergistic enhancement of fast ion diffusion is found for toroidal field ripple with collisions. The total loss is calculated to be roughly twice the sum of ripple and collisional losses calculated separately. Discrepancies between measurements and calculations of plasma beta at low current and large major radius are resolved when both effects are included for neutral beam ions. A 20–30% reduction in alpha particle heating is predicted for q_a = 6–14, R = 2.6 m DT plasmas on TFTR due to first orbit and collisional stochastic ripple diffusion.

24875 (PPPL–3114) **Alfven cyclotron instability and ion cyclotron emission.** Gorelenkov, N.N.; Cheng, C.Z. Princeton Univ., NJ (United States). Plasma Physics Lab. Jul 1995. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE95016239. Source: OSTI; NTIS; INIS; GPO Dep.

Two-dimensional solutions of compressional Alfven eigenmodes (CAE) are studied in the cold plasma approximation. For finite inverse aspect ratio tokamak plasmas the two-dimensional eigenmode envelope is localized at the low magnetic field side with the radial and poloidal localization on the order of $a/\sqrt{m}$ and a/(fourth root of m), respectively, where m is the dominant poloidal mode number. Charged fusion product driven Alfven Cyclotron Instability (ACI) of the compressional Alfven eigenmodes provides the explanation for the ion cyclotron emission (ICE) spectrum observed in tokamak experiments. The ACI is excited by fast charged fusion products via Doppler shifted cyclotron wave-particle resonances. The ion cyclotron and electron Landau dampings and fast particle instability drive are calculated perturbatively for deuterium-deuterium (DD) and deuterium-tritium (DT) plasmas. Near the plasma edge at the low field side the velocity distribution function of charged fusion products is localized in both pitch angle and velocity. The poloidal localization of the eigenmode enhances the ACI growth rates by a factor of $\sqrt{m}$ in comparison with the previous results without poloidal envelope. The thermal ion cyclotron damping determines that only modes with eigenfrequencies at multiples of the edge cyclotron frequency of the background ions can be easily excited and form an ICE spectrum similar to the experimental observations. Theoretical understanding is given for the results of TFTR DD and DT experiments with $v_{\alpha 0}/v_A < 1$ and JET experiments with $v_{\alpha 0}/v_A > 1$.

24876 (PPPL–3116) **Enhanced loss of fusion products during mode conversion heating in TFTR.** Darrow, D.S.; Majeski, R.; Fisch, N.J.; Heeter, R.F.; Herrmann, H.W.; Herrmann, M.C.; Zarnstorff, M.C.; Zweben, S.J. Princeton Univ., NJ (United States). Plasma Physics Lab. Jul 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE95016240. Source: OSTI; NTIS; INIS; GPO Dep.

Ion Bernstein waves (IBWS) have been generated by mode conversion of ion cyclotron range of frequency (ICRF) fast waves in TFTR. The loss rate of fusion products in these discharges can be large, up to 10 times the first orbit loss rate. The losses are observed at the passing/trapped boundary, indicating that passing particles are being moved onto loss orbits either by increase of their $v_\perp$ due to the wave, by outward transport in minor radius, or both. The lost particles appear to be DD fusion produced tritons heated to ~1.5 times their birth energy.

24877 (PPPL–3120) **Experimental study of toroidicity-induced Alfven eigenmode (TAE) stability at high q(0).** Batha, S.H. (Fusion Physics and Technology, Torrance, CA (United States)); Levinton, F.M.; Spong, D.A. Princeton Univ., NJ (United States). Plasma Physics Lab. Jul 1995. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE95016241. Source: OSTI; NTIS; INIS; GPO Dep.

Experiments to destabilize the Toroidicity-induced Alfven Eigenmode (TAE) by energetic alpha particles were performed on the Tokamak Fusion Test Reactor using deuterium and tritium fuel. To decrease the alpha particle pressure instability threshold, discharges with an elevated value of q(0) > 1.5 were used. By raising q(0), the radial location of the low toroidal-mode-number TAE gaps moves toward the magnetic axis and into alignment with the region of maximum alpha pressure gradient, thereby (in theory) lowering the value of $\beta_\alpha(0)$ required for instability. No TAE activity was observed when the central alpha particle β_α reached 0.08% in a discharge with fusion power of 2.4 MW. Calculations show that the fusion power is within a factor of 1.5 to 3 of the instability threshold.

24878 (PSC–39) **^{3}He-enrichments by magnetosonic waves in current-driven instabilities.** Zhang, T.X.; Ohsawa, Y. Nagoya Univ. (Japan). Plasma Science Center. Dec 1994. 41p. Order Number DE95789262. Source: OSTI; NTIS; INIS.

A theoretical model for ^{3}He-enrichments in solar energetic particles is developed. First, current-driven, electrostatic instabilities that have frequencies $\omega \simeq n\Omega_{^3He}$ ($\Omega_{^3He}$ is the cyclotron frequency of ^{3}He) are investigated for a plasma consisting of H, ^{4}He, ^{3}He, and electrons with the density of ^{3}He much lower than those of H and ^{4}He. It is found that in many cases the oblique ion acoustic waves can have positive growth rates at frequencies $\omega \simeq \Omega_{^3He}$ and, at the same time, negative growth rates at $\omega \simeq \Omega_{^4He}$ and at $\omega \simeq \Omega_H$. This can occur near the marginal state of the instability. The wave damping at these frequencies is caused by the cyclotron resonances of ^{4}He and H. The cyclotron damping at $\omega \simeq \Omega_{^3He}$ is negligible, however, because the abundance of ^{3}He is very small. The H cyclotron waves can be unstable at $\omega \simeq 2\Omega_{^3He}$ for a wide region of plasma parameters; the electron-to-ion temperature ratio must be $T_e/T_H >$ or approx. 1.5. To destabilize the ^{4}He cyclotron waves with $\omega \simeq \Omega_{^3He}$, high ^{4}He density and high electron temperature are both required. Then, ^{3}He-enrichments are studied on the basis of the theory of nonlinear magnetosonic waves, which can promptly accelerate ions. The current-driven electrostatic waves with $\omega \simeq n\Omega_{^3He}$ can enhance fluctuation velocities of ^{3}He. Thus, in the presence of these waves, magnetosonic waves can selectively accelerate ^{3}He particles to high energies. Finally, cyclotron resonances of heavy ions with the waves $\omega \simeq n\Omega_{^3He}$ or $\omega < \Omega_{^4He}$ are briefly discussed. (author).

24879 (UCRL-ID–119072) **Extrapolation of the Dutch 1 MW tunable free electron maser to a 5 MW ECRH source.** Caplan, M. (Lawrence Livermore National Lab., CA (United States)); Nelson, S.; Kamin, G.; Antonsen, T. Levush, B.; Urbanus, W.; Tulupov, A. Lawrence Livermore National Lab., CA (United States). 1 Apr 1995. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014381. Source: OSTI; NTIS; INIS; GPO Dep.

A Free Electron Maser (FEM) is now under construction at the FOM Institute (Rijnhuizen) Netherlands with the goal of producing 1 MW long pulse to CW microwave output in the range 130 GHz to 250 GHz with wall plug efficiencies of 50% (Verhoeven, et al EC-9 Conference). An extrapolated version of this device is proposed which by scaling up the beam current, would produce microwave power levels of up to 5 MW CW in order to reduce the cost per watt and increase the power per module, thus providing the fusion community with a practical ECRH source.

24880 (UCRL-ID–120159) **Core, edge, and divertor LIDAR Thomson scattering for ITER.** Molvik, A.W.; Hooper, E.B.; Lerche, R.A.; Perry, M.D. Lawrence Livermore National Lab., CA (United States). 26 Apr 1995. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95012259. Source: OSTI; NTIS; GPO Dep.

Short communication. ITER TOKAMAK/optical radar; OPTICAL RADAR/thomson scattering; OPTICAL RADAR/plasma diagnostics; DIVERTORS; STREAK CAMERAS; CHARGE-COUPLED DEVICES; PLASMA SCRAPE-OFF LAYER

24881 (UCRL-JC–119843) **Weakly relativistic modeling of refraction and absorption for waves with small $N_\parallel$.** Smith, G.R. (Lawrence Livermore National Lab., CA (United States)); Pearlstein, L.D.; Kritz, A.H. Lawrence Livermore National Lab., CA (United States); Lehigh Univ., Bethlehem, PA (United States). Jan 1995. 8p. Sponsored by USDOE, Washington, DC (United States);Atomic Energy of Canada Ltd., Ottawa, ON (Canada);Hydro-Quebec, Montreal, PQ (Canada);Schweizerischer Nationalfonds zur Foerderung der Wissenschaftlichen Forschung, Bern (Switzerland). DOE Contract W-7405-ENG-48 ; FG02-92ER54141. (CONF-950112–3: 9. joint workshop on electron cyclotron emission and electron cyclotron resonance heating, Borrego Springs, CA (United States), 23-26 Jan 1995). Order Number DE95013428. Source: OSTI; NTIS; INIS; GPO Dep.

Transmission measurements for waves near the fundamental and harmonics of the electron-cyclotron frequency indicate that propagation and absorption is not always correctly described when ray trajectories are obtained using cold-plasma analysis. Improved methods have been developed for evaluating the Shkarofsky functions, which appear in the weakly relativistic approximation of the dielectric tensor, for small parallel index of refraction. Computational results for vertical third-harmonic X-mode propagation in Tore Supra show strong, warm-plasma refraction effects that qualitatively agree with experimental observations.

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Refer also to citation(s) 23854, 23932, 24037, 24039, 24860, 24868

24882 (CIEMAT–755) **Exporting Variables in a Hierarchically Distributed Control System.** Diaz Martin; Martinez Laso, L. No corporate text available. 1995. 20p. Order Number DE95780844. Source: OSTI; NTIS; INIS.

We describe the Remote Variable Access Service (RVAS), a network service developed and use in the distributed control and monitoring system of the TJ-II Heliac, which is under construction at CIEMAT (Madrid, Spain) and devoted to plasma studies in the nuclear fusion field. The architecture of the TJ-II control system consists of one central Sun workstation Sparc 10 and several autonomous subsystems based on VME crates with embedded processors running the os-9 (V.24) real time operating system. The RVAS service allows state variables in local control processes running in subsystems to be exported to remote processes running in the central control workstation. Thus we extend the concept of exporting of file systems in UNIX machines to variables in processes running in different machines. (Author)

24883 (CONF-941182–4) **Prospects and status of low-aspect-ratio tokamaks.** Peng, Y.K.M. Oak Ridge National Lab., TN (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. international Toki conference on plasma physics and controlled nuclear fusion: Research for advanced concepts in magnetic fusion; Toki-city (Japan); 29 Nov - 2 dec 1994. Order Number DE95013044. Source: OSTI; NTIS; INIS; GPO Dep.

The prospects for the low-aspect-ratio (A) tokamak to fulfill the requirements of viable fusion power plants are considered relative to the present status in data and modeling. Desirable physics and design features for an attractive Blanket Test Facility and power reactors are estimated for low-A tokamaks based on calculations improved with the latest data from small pioneering experiments.

While these experiments have confirmed some of the recent predictions for low-A, they also identify the remaining issues that require verification before reliable projections can be made for these deuterium-tritium applications. The results show that the low-A regime of small size, modest field, and high current offers a path complementary to the standard and high A tokamaks in developing the full potential of fusion power.

24884 (CONF-950892–8) **Energy-filtered plasmon images of $MgAl_2O_4$ implanted with Al^+ and Mg^+ ions.** Evans, N.D. (Oak Ridge Inst. for Science and Education, Oak Ridge, TN (United States)); Bentley, J.; Zinkle, S.J. Oak Ridge National Lab., TN (United States). [1995]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 53. annual meeting of Microscopy Society of America; Kansas City, KS (United States); 13-17 Aug 1995. Order Number DE95013036. Source: OSTI; NTIS; INIS; GPO Dep.

Magnesium aluminate spinel ($MgAl_2O_4$) is a candidate material for specialized applications in proposed fusion reactors, and previously, has been irradiated with Al^+ or Mg^+ ions to assess the effects of high-dose irradiation. Electron energy-loss spectrometry (EELS) has been used to confirm the identity of metallic aluminum colloids located in the ion-implanted region of the spinel because electron diffraction experiments were inconclusive for phase identification. In the present study, energy-filtered plasmon images of the ion-implanted region have been obtained to reveal this colloid distribution.

24885 (CONF-951001–1) **Prospects for Tokamak Fusion Reactors.** Sheffield, J.; Galambos, J. Oak Ridge National Lab., TN (United States). [1995]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 16. World Energy Council congress; Makuhari (Japan); 8-13 Oct 1995. Order Number DE95009078. Source: OSTI; NTIS; INIS; GPO Dep.

This paper first reviews briefly the status and plans for research in magnetic fusion energy and discusses the prospects for the tokamak magnetic configuration to be the basis for a fusion power plant. Good progress has been made in achieving fusion reactor-level, deuterium-tritium (D-T) plasmas with the production of significant fusion power in the Joint European Torus (up to 2 MW) and the Tokamak Fusion Test Reactor (up to 10 MW) tokamaks. Advances on the technologies of heating, fueling, diagnostics, and materials supported these achievements. The successes have led to the initiation of the design phases of two tokamaks, the International Thermonuclear Experimental Reactor (ITER) and the US Toroidal Physics Experiment (TPX). ITER will demonstrate the controlled ignition and extended burn of D-T plasmas with steady state as an ultimate goal. ITER will further demonstrate technologies essential to a power plant in an integrated system and perform integrated testing of the high heat flux and nuclear components required to use fusion energy for practical purposes. TPX will complement ITER by testing advanced modes of steady-state plasma operation that, coupled with the developments in ITER, will lead to an optimized demonstration power plant.

24886 (DOE/ER/54177–T3) **NRL HIFAR research program annual progress report FY92/93.** Department of the Navy, Washington, DC (United States). [1993]. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-92ER54177. Order Number DE95014301. Source: OSTI; NTIS; INIS; GPO Dep.

Progress during this reporting period has spanned several areas ranging from studies of fundamental intense-beam transport physics, including comparisons of simulations with experimental results, to accelerator system design and simulation code development. Performance of the research described here has continued to benefit from the close collaboration with personnel at LBL and LLNL. In addition, studies of the longitudinal and transverse physics, which are jointly supported by the Division of High Energy Physics of the US Department of Energy, have benefitted from collaboration with personnel at the University of Maryland associated with the Maryland transport experiment. The research results supported by this program have been, and will be, actively reported to the scientific community through papers presented at conferences and published in conference proceedings as well as in the refereed literature. The work which has been documented for publication is described, in detail, in copies of the referenced material provided in the Appendix. This work is also summarized briefly in the next section. An additional section describing, in depth, research which has not yet been prepared for publication, is also included. This work investigates the basic nonlinear physics which is important to the design of large aperture magnetic quadrupole transport systems, as well as the numerical requirements for reliable simulation of that physics.

24887 (DOE-STD–0028-95) **Safety of magnetic fusion facilities: Volume 2, Guidance.** USDOE, Washington, DC (United States). [1995]. 194p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M–4464). Order Number DE95014645. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides guidance for the implementation of the requirements identified in Vol. 1 of this Standard. This guidance is intended for the managers, designers, operators, and other personnel with safety responsibilities for facilities designated as magnetic fusion facilities. While Vol. 1 is generally applicable in that requirements there apply to a wide range of fusion facilities, this volume is concerned mainly with large facilities such as the International Thermonuclear Experimental Reactor (ITER). Using a risk-based prioritization, the concepts presented here may also be applied to other magnetic fusion facilities. This volume is oriented toward regulation in the Department of Energy (DOE) environment.

24888 (GSI–94-13) **Environmental aspects of prospective energy generation by the inertial confinement fusion process. Pt. A. DT fusion.** Weyrich, K. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Nov 1994. 110p. (In German). Order Number DE95796233. Source: OSTI; NTIS (US Sales Only); INIS.

The report explains the design scenario of ICF reactors, their radioactive inventories (tritium, radioactive wastes and radioactive scrap), and their impact on the environment, as well as the possible environmental impacts emanating from the emission of tritium and other isotopes during reactor operation. The reactor concepts discussed are: (1) HIBALL-II (2) HYLIFE-II (3) Prometheus-H (4) OSIRIS (5) LOTRIT. (HP)

24889 (INIS-mf–15115) **Max-Planck-Institut fuer Plasmaphysik. Annual report 1994.** Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). 1994. 154p. Order Number DE95790263. Source: OSTI; NTIS (US Sales Only); INIS.

The report covers progress of the ASDEX Upgrade divertor tokamak and of the WENDELSTEIN 7-AS and WENDELSTEIN 7-X project. (orig.)

24890 (JAERI-Research–95-017) **Bulk shielding experiment on a large SS316/water assembly bombarded by D-T neutrons. V. 1. Experiment.** Konno, Chikara (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Maekawa, Fujio; Oyama, Yukio; Ikeda, Yujiro; Uno, Yoshitomo; Verzilov, Y.; Wada, Masayuki; Maekawa, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 82p. Order Number DE95789316. Source: OSTI; NTIS; INIS.

It is under consideration in the ITER/EDA that water will be flowed through stainless steel in the shielding blanket and vacuum vessel as coolant. A bulk shielding experiment on a large SS316/water assembly was performed by using the FNS D-T neutron source in Japan Atomic Energy Research Institute as the '94 ITER/EDA task(T-16). The objectives of this experiment are to obtain experimental data for the shielding performance of SS316/water shield, to verify the shielding design system of ITER and to deduce the shielding design margin finally. The experimental system, measuring procedures and the measured data are described in this report and the analysis of the experiment is given separately in the Volume II. The test region of the experimental assembly is a layered structure of SS316 and water(volume ratio is 4:1), which had a cylindrical shape of 1200 mm in diameter and 1372 mm in thickness. This test region was set at 300 mm from the D-T neutron source which was surrounded by a source reflector made of 200 mm-thick SS316. The data for (i) neutron spectra in energy regions of MeV, keV and eV, (ii) neutron activation reaction rates, (iii) fission rates, (iv) gamma-ray spectra and (v) gamma-ray heating rates were measured from the front surface to the depth of 914 mm in the test region. The experimental data which included few

room-returned background were obtained even at the depth of 914 mm by adding water tanks or polyethylene blocks of about 160 mm in thickness around the rear part of the test region. The effect of water in SS316 on the shielding performance was examined from the comparison with the measured data of the previous SS316 bulk shielding experiments. It was found that SS316/water shield has shielding performance better by about 2 orders of magnitude than pure SS316 for neutrons less than 1 MeV and gamma-rays at the depth of 914 mm. (author).

24891 (JAERI-Research–95-018) **Bulk shielding experiment on a large SS316/water assembly bombarded by D-T neutrons. V. 2. Analysis.** Maekawa, Fujio (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Konno, Chikara; Wada, Masayuki; Oyama, Yukio; Ikeda, Yujiro; Uno, Yoshitomo; Verzilov, Y.; Maekawa, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 126p. Order Number DE95789304. Source: OSTI; NTIS; INIS.

As a part of the Engineering Design Activities (EDA) of the International Thermonuclear Experimental Reactor (ITER), the bulk shielding experiment on a large SS316/water assembly bombarded by D-T neutrons were carried out at the FNS facility in JAERI. The experimental details are described in the separate issue, Volume I. In this report, Volume II, methods and results of the experimental analysis, and comparisons of the calculated results with the experiments are compiled. Two transport calculation codes, MCNP-4 and DOT-3.5, and cross section libraries based on JENDL-3.1 and JENDL-3.2 were used in the analysis. As a result, the following facts were found for shielding properties of the SS316/water shield to both neutrons and gamma-rays; (i) Neutron fluxes from 14 MeV down to thermal energy and gamma-ray heating rates can be predicted with high accuracy within 20% by the MCNP calculation with JENDL-3.2 and the DOT calculation with consideration of the self-shielding correction and 125-neutron and 40-gamma-ray energy groups. (ii) Although influences of the self-shielding correction and the number of energy groups are not so large as in the case of SS316 assemblies, further uncertainty of about 20% should be taken into the calculated results when the correction is omitted or 42-neutron and 21-gamma-ray energy groups are used. (iii) If thermal neutron fluxes are expressed in one energy group in multi-group calculations, a large error may be involved in the calculated results of thermal neutron flux in some cases. (author).

24892 (JAERI-Research–95-023) **Development of dual CO_2 laser interferometer for large tokamak.** Kawano, Yasunori (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Nagashima, Akira; Hatae, Takaki; Gunji, Soichi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 33p. Order Number DE95789320. Source: OSTI; NTIS; INIS.

A new CO_2 laser interferometer has been developed to measure electron density of tokamak plasmas. Two different wavelength oscillators of 10.6 μm and 9.27 μm are utilized for simultaneous measurement of the density component and the optical path length change. A new technique of the common use of a frequency shifter for two color lasers improves the stability of the system by a complete matching of both beat frequencies. The system has advantages on practical problems of window darkening, large mechanical vibrations of reflection mirrors, monitoring of laser beams and simplified the optical layout design by using the close wavelength. The electron density of JT-60U plasma is successfully measured up to a plasma current of 3 MA. The density behavior of fast major disruptions are also diagnosed without a fringe loss. The effective density resolution is observed as 2×10^{19} m^{-2}, which corresponds to about a 1/10 fringe. An ultra high resolution ($1/10^4$ fringe) phase comparator has been developed to improve the density resolution of the dual CO_2 system. Achieved performance shows the feasibility of the dual CO_2 laser interferometer for future large devices such as ITER. (author).

24893 (JAERI-Tech–95-006) **Neutron spectral tailoring calculation in the JMTR. Feasible study on irradiation test simulating the fusion reactor condition.** Nagao, Yoshiharu (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Shimakawa, Satoshi; Komori, Yoshihiro; Sakurai, Fumio. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 52p. (In Japanese). Order Number DE95789283. Source: OSTI; NTIS; INIS.

By adjusting the thermal-to-fast neutron flux ratio, it is feasible to carry out irradiation tests to simulate fast reactor or fusion reactor conditions and examine neutron spectrum effect in basic study of materials in testing reactor with mixed neutron spectrum such as the JMTR. For fusion reactor materials irradiation, the He-to-dpa ratio has been tailored to a fusion reactor condition (15 appm He/dpa). Thermal neutron irradiation of nickel-bearing materials generate high levels of helium due to $^{58}Ni(n,\gamma)^{59}Ni(n,\alpha)^{56}Fe$ reaction. This process is used to simulate fusion reactor He-to-dpa ratio in stainless steel-316. This paper describes the analytical result on the possible range of He-to-dpa ratio to simulate fusion reactor condition for stainless steel-316 irradiation in the JMTR. NIHE program was developed to evaluate helium production due to the ^{58}Ni two step reaction. It was found that He-to-dpa ratio in stainless steel-316 irradiation is able to be tailored within 13-15 appm He/dpa in the JMTR. (author).

24894 (JAERI-Tech–95-008) **Tokamak assembly and tooling.** Nakahira, Masataka (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Tada, Eisuke; Kanamori, Naokazu; Kakudate, Satoshi; Oka, Kiyoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1995. 78p. Order Number DE95789284. Source: OSTI; NTIS; INIS.

In fusion experimental reactors such as ITER, the reactor core will be highly activated due to D-T operation and the components inside the cryostat will have to be assembled and replaced by remote operation. Many of assembly procedures will have to be applied to remote replacement at a later time. Thus, fusion reactors should have replacable features which accommodate machine layout and structural configuration fully compatible with remote operation. From this point of view, this paper summarizes investigations about present outline design of ITER and the recommended overall design approach, philosophy and procedures for the assembly and replacement. (author).

24895 (JAERI-Tech–95-011) **Compatibility test of blanket structural materials with beryllium sphere in helium gas environment.** Kurasawa, Toshimasa (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Takatsu, Hideyuki; Seki, Masahiro; Ono, Kiyoshi; Kobayashi, Shigetada. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 31p. Order Number DE95789314. Source: OSTI; NTIS; INIS.

Compatibility of blanket structural materials with beryllium spheres under the helium environment was studied at temperatures of 650-750degC for periods of 700 and 1500hr. The examined materials were 316 stainless steel as a reference material and advanced structural materials such as titanium alloy (Ti-6Al-4V), reduced activity ferritic steel (F82H) and vanadium, all of which are candidate materials in the ITER blanket design. Reactions of Ti-6Al-4V alloy and F82H with Be sphere in helium gas containing impurities were occurred at the test of 750degC, 700hrs and 700degC, 1500hrs. It was not observed at the test of 700degC, 700hrs. This indicated that these blanket structural materials are less compatible with Be and helium containing impurities under the condition of high temperature over 700degC. In the case of vanadium, oxidation was observed at 750degC, 1500hrs in the helium environment. Clear grain boundary grooving was formed on the vanadium surface contacted with He. No obvious surface reaction layer was formed in the helium exposure test of 700degC, 1500hrs. This preliminary result shows that upper temperature limit of these advanced materials is around 700degC, though compatibility capabilities are nominally greater than that of 316 stainless steel as the reference material. (author).

24896 (JAERI-Tech–95-018) **Design study on a 1MeV, 12.5MW neutral beam injector module for ITER.** Okumura, Yoshikazu (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Hanada, Masaya; Inoue, Takashi; Miyamoto, Kenji; Ohara, Yoshihiro; Watanabe, Kazuhiro; Zimin, S.; Maki, Koichi; Maeno, Shuichi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 112p. Order Number DE95789345. Source: OSTI; NTIS; INIS.

A high energy neutral beam injector has been designed for the International Thermo-nuclear Experimental Reactor(ITER). Two

types of designs are proposed; a short beamline option and a long beamline option. The short beamline option is characterized by a very short neutralizer, which makes it possible to integrate all the beamline components within the cryostat of ITER. The long beamline option has a conventional layout, where the beamline is installed outside the cryostat. In both cases, the system is more compact and more reactor-relevant than the ITER-CDA(Conceptual Design Activity) design, since the present design is based on the recent progress on the negative ion beam development. In the design, 25A D-ion beam is produced by a cesium-seeded volume negative ion source and accelerated to 1MeV by a multi-stage electrostatic accelerator. The beam is neutralized in a gas cell and 12.5MW (1MeV, 12.5A) neutral beam is injected into each injection port. Using 4 NBI modules and 4 ports, 50MW is to be injected into the plasma in ITER. A special emphasis is laid on the radiation shielding and the radiation effects in the beamline components, which was considered to be a serious problem in applying a neutral beam system for ITER. We found that the irradiation dose rate in the beamline components including the ion source/accelerator can be suppressed to a moderate value and no serious damage on these components is expected. (author).

24897 (JAERI-Tech--95-021) **Test program development for ITER blanket design.** Kurasawa, Toshimasa (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Sato, Satoshi; Furuya, Kazuyuki; Nakahira, Masataka; Togami, Ikuhide; Hashimoto, Toshiyuki; Takatsu, Hideyuki; Kuroda, Toshimasa. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 30p. Order Number DE95789313. Source: OSTI; NTIS; INIS.

Test programs for water-cooled and helium-cooled blankets have been developed. Following the description of ITER Experimental and DEMO reactors and blankets proposed for it, which are recently developed in Japan, test items and their features are indicated, Tests required for the development of ITER and DEMO blankets consist of neutronics test, scoping test, performance and performance verification tests, reliability enhancement test, and segment demonstration test. Procedure for these tests has been evolved on the assumption that neutron fluences onto test ports during the BPP and the EPP are 0.1 MWa/m^2 and 1-3 MWa/m^2, respectively. Comprehensive tests of the ITER driver blanket during the BPP are also proposed, which consist of neutronics and performance verification tests. (author).

24898 (JAERI-Tech--95-022) **Heat transfer experiments on the cooling tubes for divertor plates under one-sided heating conditions.** Araki, Masanori (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Ogawa, Masuro; Kunugi, Tomoaki. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 97p. Order Number DE95789325. Source: OSTI; NTIS; INIS.

No literatures and experimental results have been published so far prediction of heat transfer coefficients under one-sided heating conditions. It is a recent concern whether or not existing correlations developed for uniform heating conditions, i. e., Thom and/of Shah (Jens-Lottes) correlations, are applicable to one-sided heating conditions. Furthermore, they predict different values as large as twice even if the identical calculation condition is applied. This reason is attributable mainly to lack of database and wide extrapolation at high superheat region. In the cooling channel of the divertor plates, partial nucleate boiling will be expected due to high heat flux, resulting in the difficulty on the design such as the evaluation of the surface temperature of plasma facing components. Therefore, JAERI has carried out heat transfer experiments on two different test samples to systematically evaluate heat transfer phenomena under one-sided heating conditions. In the experiments, temperature profile along the circumference of the test sample were measured at a condition for the inlet water temperature from 20 to 80degC, the local water pressure from 0.5 to 1.5 Mpa, the flow velocity from 4 to 16m/s, and the peak surface heat flux ranged from 2 MW/m^2 to burnout. Simple comparisons between the experimental data and the existing heat transfer correlations were also done to investigate the applicability of use of the existing correlation to one-sided heating conditions. As a result of the comparison, the existing correlations are applicable to one-sided heating conditions at non-boiling region, but can not predict to the experimental results at partial nucleate boiling region with high superheat. As a first step to determine heat transfer correlations, an inverse analysis code of heat conduction problems was developed. (author).

24899 (JAERI-Tech--95-028) **Radiological safety of DT experiments at TFTR.** Miya, Naoyuki (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 50p. (In Japanese). Order Number DE95789343. Source: OSTI; NTIS; INIS.

Radiological safety problems of TFTR D-T experiments are described. Some topical issues of safety, such as current regulations, radiation shielding, radioactivation and tritium processing on TFTR are reported. During D-T experiments around 1x10^{20} D-T neutrons were produced and 20g of tritium have been processed for the first ten months. Prior to the experiment interior walls inside Test Cell were clad with supplementary shielding panels. Contribution of radioactivity to annual property line total dose equivalent is less than 2.4 mrem for an estimated maximum D-T neutron yield of 1x10^{21}/y. This result is consistent with the design objective of limiting the total dose at the property line, 10 mrem/y. Activation dose rate near vacuum vessel reaches 100 mrem/h during operations. Because of the TFTR site limit of 5g inventory on-site, TFTR operations are currently scheduled to have an on-site delivery of tritium every two weeks and corresponding off-site shipment of tritiated water. TFTR installed and commissioned a Tritium Purification System(TPS) which will provide on-site tritium purification and recycle capability. After the completion of two years D-T experiments, decontamination and decommissioning activities will commence for three years. (author).

24900 (JINR-D--13-92-581, pp. 223-227) **The use of programmable controllers in the control and monitoring system of a large nuclear fusion experiment.** Hemming, O.N.; Luchetta, A.; Schmidt, V.; Vitturi, S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (CONF-9209499--: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

Industrial programmable controllers are widely used not only in the field of production automation but in the course of performing large-scale physical experiments, for example, in nuclear fusion reaction studies or in the area of high-energy physics, which require constant observance and control. Their broad expansion was promoted by the following peculiarities: relatively low costs, built-in communication system, built-in man-computer interface and introduction of simple software. The application of programmable controllers is oriented mainly at relatively slow processes (not less than tens of milliseconds), highly-dependent on the number of inlets/outlets and on the applied software as well. The paper contains the authors report on achievements in the area of programmable controllers development, design and realization. The operation of modern systems for management and control over large-scale thermonuclear fusion synthesis is considered. 9 refs.; 3 figs.; 1 tab.

24901 (JINR-D--13-92-581, pp. 228-235) **The graphical user interface of the CAMAC based data acquisition system of the RFX nuclear fusion experiment.** Flor, G.; Fredian, T.W.; Fregonese, G.; Manduchi, G.; Stillerman, J.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (CONF-9209499--: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The graphical interface of the CAMAC data acquisition system intended for the RFX nuclear fusion experiment is described. The data acquisition system is developed on the basis of the VAX computers and the MDS-Plus software package which is based on the concept of an experiment model. The structure and possibilities of the MDS-Plus package is considered in details. It provides graphical interfaces both for experiment model editing and interactive display. 7 refs.; 4 figs.

24902 (LA-UR–95-1439) **The design and characterization of toroidal-shaped Nova hohlraums that simulate National Ignition Facility plasma conditions for plasma instability experiments.** Wilde, B.H. (Los Alamos National Lab., NM (United States)); Fernandez, J.C.; Hsing, W.W.; Cobble, J.A.; Delamater, N.D.; Krauser, W.J.; Lindman, E.L.; Failor, B.H. Los Alamos National Lab., NM (United States). [1995]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-950476–5: 12. international conference on laser interaction and related plasma phenomena, Osaka (Japan), 24-28 Apr 1995). Order Number DE95014010. Source: OSTI; NTIS; INIS; GPO Dep.

Special Nova hohlraums have been designed to simulate the plasma conditions calculated for various NIF hohlraum point designs. These hohlraums attempt to maximize the laser pathlength for parametric instability measurements. A toroidal-shaped hohlraum with a diameter of 3200 microns and a length of 1600 microns allows a laser pathlength of about 2 mm. Filling the hohlraum with 1 atmosphere of neopentane gas gives an electron temperature of 3 keV and electron density near 0.1 of critical. Detailed LASNEX calculations for these hohlraums and comparisons to the NIF point design will be presented. Comparisons between data and calculations that characterize the plasma conditions (electron, radiation, and ion temperatures, electron density, etc) in these Nova hohlraums will also be shown.

24903 (LBL–36487) **A high charge state heavy ion beam source for HIF.** Eylon, S. (Duly Research, Inc., Rancho Palos Verdes, CA (United States)); Henestroza, E. Lawrence Berkeley Lab., CA (United States). Apr 1995. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098 ; FG03-94ER81741. (CONF-950512–282: Particle accelerator conference, Dallas, TX (United States), 1-5 May 1995). Order Number DE95014782. Source: OSTI; NTIS; INIS; GPO Dep.

A high current low emittance high charge state heavy ion beam source is being developed. This is designed to deliver HIF (heavy ion fusion) driver accelerator scale beam. Using high-charge-state beam in a driver accelerator for HIF may increase the acceleration efficiency, leading to a reduction in the driver accelerator size and cost. The proposed source system which consists of the gas beam electron stripper followed by a high charge state beam separator, can be added to existing single charge state, low emittance, high brightness ion sources and injectors. We shall report on the source physics design using 2D beam envelope simulations and experimental feasibility studies' results using a neutral gas stripper and a beam separator at the exit of the LBL 2 MV injector.

24904 (LBL-PUB–754, pp. 257-262) **The "first" problem.** Holsinger, R.F. Lawrence Berkeley Lab., CA (United States). Feb 1995. In *The art and science of magnet design: A Festschrift in honor of Klaus Halbach. Volume 1.* 202p. Order Number DE95008449. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the first magnet design problem that Klaus and the author worked on together. At the time, over 30 years ago, Klaus was working as a plasma physicist in the Controlled Thermonuclear Research (CTR) Group, and the author was assigned from the Mechanical Engineering Department to help with the design of experimental equipment for various research projects. Klaus' primary research program was to develop a "plasma gun" for injecting plasma into "mirror machines." As described, the magnet design aspect of this plasma gun was a challenging task, and led to some innovations that were quite advanced at that time.

24905 Direct current sputtering of boron from boron/carbon mixtures. Timberlake, J.R.; Manos, D.; Nartowitz, E. 1993. Filed date 27 May 1993. U.S. Patent Application 8-067,967. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE95015040. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A method for coating a substrate with boron by sputtering includes lowering the electrical resistance of a boron-containing rod to allow electrical conduction in the rod; placing the boron-containing rod inside a vacuum chamber containing substrate material to be coated; applying an electrical potential between the boron target material and the vacuum chamber; countering a current avalanche that commences when the conduction heating rate exceeds the cooling rate, and until a steady equilibrium heating current is reached and coating the substrate material with boron by sputtering from the boron-containing rod.

24906 (SAND–93-3918C) **High quality actively cooled plasma facing components for fusion.** Nygren, R. Sandia National Labs., Albuquerque, NM (United States). [1993]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940664–36: ISFNT-3: 3rd international symposium on fusion nuclear technology, Los Angeles, CA (United States), 27 Jun - 1 jul 1994). Order Number DE95013025. Source: OSTI; NTIS; INIS; GPO Dep.

This paper interweaves some suggestions for developing actively-cooled PFCs (plasma facing components) for future fusion devices with supporting examples taken from the design, fabrication and operation of Tore Supra's Phase III Outboard Pump Limiter (OPL). This actively-cooled midplane limiter, designed for heat and particle removal during long pulse operation, has been operated in essentially thermally steady state conditions. From experience with testing to identify braze flaws in the OPL, recommendations are made to analyze the impact of joining flaws on thermal-hydraulic performance of PFCs and to validate a method of inspection for such flaws early in the design development. Capability for extensive in-service monitoring of future PFCs is also recommended and the extensive calorimetry and IR thermography used to confirm and update safe operating limits for power handling of the OPL are reviewed.

24907 (UCRL–52000-95-4) **Energy & technology review, April 1995.** Bookless, W.A.; Stull, S. (eds.). Lawrence Livermore National Lab., CA (United States). Apr 1995. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015109. Source: OSTI; NTIS; INIS; GPO Dep.

This publication presents research overviews on projects from the Lawrence Livermore laboratory. This issue provides information on microsphere targets for inertial confinement fusion experiments; laser fabrication of berllium components; and the kinetic energy interceptor.

24908 (UCRL-CR–120302-Pt.2) **Final report task order number B239641 between the Regents of the University of California and Institute of Experimental Physics task 2: Switch development.** Galakhov, I.V. (Russian Federal Nuclear Center (Russian Federation)); Gruzin, I.A.; Gudov, S.N.; Kirillov, G.A.; Logutenko, S.L.; Murugov, V.M.; Osin, V.A.; Zolotovskii, V.I. Lawrence Livermore National Lab., CA (United States); Russian Federal Nuclear Center (Russian Federation). 1994. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013269. Source: OSTI; NTIS; INIS; GPO Dep.

The LLNL project of the pulsed power system for the National Ignition Facility requires a switch with the following operational parameters: peak current of 400 kA, the transferred charge of 150 C, operating voltage of 25 kV, and reliable operating life of 10,000 shots. A review of high-power switches is given with detailed studies on vacuum switches and semiconductor switches.

24909 (UCRL-ID–118528) **NIF target fill, transport and insertion cryostat.** Warren, R. Lawrence Livermore National Lab., CA (United States). 20 Sep 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95011765. Source: OSTI; NTIS; INIS; GPO Dep.

A cryostat to support the fielding of a cryogenic target within the NIF is described. The present design is predicated upon fuel layer symmetry being achieved with the β layering process and modifications needed for other fuel symmetrization processes are discussed. These include the vertically differentially heated capsule with a uniform liquid layer stabilized by a surface tension gradient, foam supported liquid layers and solid D_2 or HD layers symmetrized by bulk irradiation from a laser source. The cold sinks to be incorporated in these techniques could, in principal, be cooled with the high pressure helium envisioned for the heat sink rings of the present design. Supplementary laser access would be provided for differential heating of the capsule for surface tension gradient stabilization of a liquid layer or bulk heating of a solid layer. The cryostat in each of these cases would look substantially the same

as in the present case with the only significant differences being in the details of the design in the immediate vicinity of the target.

24910 (UCRL-ID–119107) **Temperature measurements of shock-compressed deuterium.** Holmes, N.C.; Ross, M.; Nellis, W.J. Lawrence Livermore National Lab., CA (United States). Nov 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015421. Source: OSTI; NTIS; INIS; GPO Dep.

The authors measured the temperatures of single and double-shocked D_2 and H_2 up to 85 GPa (0.85 Mbar) and 5,200 K. While single shock temperatures, at pressures to 23 GPa, agree well with previous models, the double shock temperatures are as much as 40% lower than predicted. This is believed to be caused by molecular dissociation, and a new model of the hydrogen EOS at extreme conditions has been developed which correctly predicts their observations. These data and model have important implications for programs which use condensed-phase hydrogen in implosion systems.

24911 (UCRL-ID–119932) **Large-aperture, high-damage-threshold optics for beamlet.** Campbell, J.H.; Atherton, L.J.; DeYoreo, J.J.; Kozlowski, M.R.; Maney, R.T.; Montesanti, R.C.; Sheehan, L.M.; Barker, C.E. Lawrence Livermore National Lab., CA (United States). 23 Feb 1995. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015383. Source: OSTI; NTIS; INIS; GPO Dep.

Beamlet serves as a test bed for the proposed NIF laser design and components. Therefore, its optics are similar in size and quality to those proposed for the NIF. In general, the optics in the main laser cavity and transport section of Beamlet are larger and have higher damage thresholds than the optics manufactured for any of our previous laser systems. In addition, the quality of the Beamlet optical materials is higher, leading to better wavefront quality, higher optical transmission, and lower-intensity modulation of the output laser beam than, for example, that typically achieved on Nova. In this article, we discuss the properties and characteristics of the large-aperture optics used on Beamlet.

24912 (UCRL-ID–120913) **Decomposable Mandrel Project. Progress report.** Letts, S.A.; Fearon, E.; Allison, L.; Buckley, S.; Saculla, M.; Cook, R. Lawrence Livermore National Lab., CA (United States). 8 May 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014515. Source: OSTI; NTIS; INIS; GPO Dep.

We report on our progress in developing a new technology to produce both Nova and NIF scale capsules using a depolymerizable mandrel. In this technique we use poly(α-methylstyrene) (PAMS) beads or shells as mandrels which are overcoated with plasma polymer. The poly(α-methylstyrene) mandrel is then thermally depolymerized to gas phase monomer which diffuses away through the more thermally stable plasma polymer coating, leaving a hollow shell. Since our last report we have concentrated on characterization of the final shell. Starting with PAMS bead mandrels leads to distorted pyrolyzed shells because of thermally induced creep of the CH coating. We found that plasma polymer coatings on hollow shell mandrels shrink isotropically during pyrolysis and maintain sphericity. We are now concentrating our efforts on the use of microencapsulated shells to prepare targets with buried diagnostic layers or inner wall surface texture.

24913 (UCRL-ID–121339) **Derivation of preliminary specifications for transmitted wavefront and surface roughness for large optics used in inertial confinement fusion.** Aikens, D. (Lawrence Livermore National Lab., CA (United States)); Roussel, A.; Bray, M. Lawrence Livermore National Lab., CA (United States). 27 Jun 1995. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015975. Source: OSTI; NTIS; INIS; GPO Dep.

In preparation for beginning the design of the Nation Ignition Facility (NIF) in the United States and the Laser Mega-Joule (LMJ) in France, the authors are in the process of deriving new specifications for the large optics required for these facilities. Traditionally, specifications for transmitted wavefront and surface roughness of large ICF optics have been based on parameters which were easily measured during the early 1980's, such as peak-to-valley wavefront error (PV) and root-mean-square (RMS) surface roughness, as well as wavefront gradients in terms of waves per cm. While this was convenient from a fabrication perspective, since the specifications could be easily interpreted by fabricators in terms which were understood and conventionally measurable, it did not accurately reflect the requirements of the laser system. For the NIF and LMJ laser systems, the authors use advances in metrology and interferometry and an enhanced understanding of laser system performance to derive specifications which are based on power spectral densities (PSD's.) Such requirements can more accurately reflect the requirements of the laser system for minimizing the amplitude of mid- and high-spatial frequency surface and transmitted wavefront errors, while not over constraining the fabrication in terms of low spatial frequencies, such as residual coma or astigmatism, which are typically of a very large amplitude compared to periodic errors. In order to study the effect of changes in individual component tolerances, it is most useful to have a model capable of simulating real behavior. The basis of this model is discussed in this paper, outlining the general approach to the "theoretical" study of ICF optics specifications, and an indication of the type of specification to be expected will be shown, based upon existing ICF laser optics.

24914 (UCRL-JC–117302) **Diode-pumped solid state laser for inertial fusion energy.** Payne, S.A. (and others); Krupke, W.F.; Orth, C.D. Lawrence Livermore National Lab., CA (United States). Nov 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9411152–6: International Atomic Energy Agency (IAEA) technical committee meeting on drivers for inertial confinement fusion, Paris (France), 14-18 Nov 1994). Order Number DE95014166. Source: OSTI; NTIS; INIS; GPO Dep.

The authors evaluate the prospect for development of a diode-pumped solid-state-laser driver in an inertial fusion energy power plant. Using a computer code, they predict that their 1 GWe design will offer electricity at 8.6 cents/kW · hr with the laser operating at 8.6% efficiency and the recycled power level at 31%. The results of their initial subscale experimental testbed of a diode-pumped solid state laser are encouraging, demonstrating good efficiencies and robustness.

24915 (UCRL-JC–117332) **Progress in heavy-ion drivers for inertial fusion.** Friedman, A. (Lawrence Livermore National Lab., CA (United States)); Bangerter, R.O.; Herrmannsfeldt, W.B. Lawrence Livermore National Lab., CA (United States). 22 Dec 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9411152–5: International Atomic Energy Agency (IAEA) technical committee meeting on drivers for inertial confinement fusion, Paris (France), 14-18 Nov 1994). Order Number DE95014134. Source: OSTI; NTIS; INIS; GPO Dep.

Heavy-ion induction accelerators are being developed as fusion drivers for ICF power production in the US Inertial Fusion Energy (IFE) program, in the Office of Fusion Energy of the US Department of Energy. In addition, they represent an attractive driver option for a high-yield microfusion facility for defense research. This paper describes recent progress in induction drivers for Heavy-Ion Fusion (HIF), and plans for future work. It presents research aimed at developing drivers having reduced cost and size, specifically advanced induction linacs and recirculating induction accelerators (recirculators). The goals and design of the Elise accelerator being built at Lawrence Berkeley Laboratory (LBL), as the first stage of the ILSE (Induction Linac Systems Experiments) program, are described. Elise will accelerate, for the first time, space-charge-dominated ion beams which are of full driver scale in line-charge density and diameter. Elise will be a platform on which the critical beam manipulations of the induction approach can be explored. An experimental program at Lawrence Livermore National Laboratory (LLNL) exploring the recirculator principle on a small scale is described in some detail; it is expected that these studies will result ultimately in an operational prototype recirculating induction accelerator. In addition, other elements of the US HIF program are described.

24916 (UCRL-JC–117389) **Production of hollow microspheres for inertial confinement fusion experiments.** Cook, R.

Lawrence Livermore National Lab., CA (United States). Dec 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941144–165: 1994 fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 28 Nov - 2 dec 1994). Order Number DE95015028. Source: OSTI; NTIS; INIS; GPO Dep.

The targets used in inertial confinement fusion (ICF) experiments at the Lawrence Livermore National Laboratory are plastic capsules roughly 0.5 mm in diameter. The capsules, which typically have wall thicknesses from 20 to 60 μm, must possess extraordinary symmetry and concentricity and must have surface finishes of less than 1000 Å peak-to-valley variation over surface contours of from 10 to 100's of μm. This paper reviews the fabrication of these capsules, focusing on the production of the thin-walled polystyrene microshell mandrel around which the capsule is built. The relationship between the capsule characteristics, especially surface finish, and capsule performance is discussed, as are the methods of surface characterization and modification necessary for experiments designed to study the effects of surface roughness on implosion dynamics. Targets for the next generation of ICF facilities using more powerful laser drivers will have to be larger while meeting the same or even more stringent symmetry and surface finish requirements. Some of the technologies for meeting these needs are discussed briefly.

24917 (UCRL-JC–117397-Rev.1) **The National Ignition Facility Project. Revision 1.** Paisner, J.A.; Campbell, E.M.; Hogan, W.J. Lawrence Livermore National Lab., CA (United States). 16 Jun 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940602–23-Rev.1: 35. annual meeting of the American Nuclear Society, New Orleans, LA (United States), 11-16 Jun 1994). Order Number DE95015032. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the National Ignition Facility is to achieve ignition and gain in inertial confinement fusion targets in the laboratory. The facility will be used for defense applications such as weapons physics and weapons effects testing, and for civilian applications such as fusion energy development and fundamental studies of matter at high temperatures and densities. This paper reviews the design, schedule, and costs associated with the construction project.

24918 (UCRL-JC–118104) **Gas-filled targets for large scale-length plasma interaction experiments on Nova.** Powers, L.V. (and others); Berger, R.L.; Munro, D.H. Lawrence Livermore National Lab., CA (United States). Nov 1994. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941101–12: Meeting of the Division of Plasma Physics of the American Physical Society, Minneapolis, MN (United States), 7-11 Nov 1994). Order Number DE95014538. Source: OSTI; NTIS; INIS; GPO Dep.

Stimulated Brillouin backscatter from large scale length gas-filled targets has been measured on Nova. These targets were designed to approximate conditions in indirect drive ignition target designs in underdense plasma electron density ($n_e \sim 10^{21}/cm^3$), temperature ($T_e > 3$ keV), and gradient scale lengths ($L_n \sim$ mm, $L_v > 6$ mm) as well as calculated gain for stimulated Brillouin scattering (SBS). The targets used in these experiments were gas-filled balloons with polyimide walls (gasbags) and gas-filled hohlraums. Detailed characterization using x-ray imaging and x-ray and optical spectroscopy verifies that the calculated plasma conditions are achieved. Time-resolved SBS backscatter from these targets is <3% for conditions similar to ignition target designs.

24919 (UCRL-JC–118156-Pt.1) **Laser-induced damage in dielectrics with nanosecond to subpicosecond pulses. I. Experimental. Part 1.** Stuart, B.C.; Herman, S.; Perry, M.D. Lawrence Livermore National Lab., CA (United States). Dec 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410155–5-Pt.1: 26. annual symposium on optical materials for high power lasers: Boulder damage symposium, Boulder, CO (United States), 24-26 Oct 1994). Order Number DE95014537. Source: OSTI; NTIS; INIS; GPO Dep.

The authors report extensive laser-induced damage threshold measurements on pure and multilayer dielectrics at 1053 and 526 mm for pulse durations, τ, ranging from 140 fs to 1 ns. Qualitative differences in the morphology of damage and a departure from the diffusion-dominated $\tau^{1/2}$ scaling indicate that damage results from plasma formation and ablation for $\tau \leq 10$ ps and from conventional melting and boiling for $\tau > 50$ ps. A theoretical model based on electron production via multiphoton ionization, Joule heating, and collisional (avalanche) ionization is in good agreement with both the pulsewidth and wavelength scaling of experimental results.

24920 (UCRL-JC–118156-Pt.2) **Laser-induced damage in dielectrics with nanosecond to subpicosecond pulses. II. Theory.** Feit, M.D. (and others); Rubenchik, A.M.; Shore, B.W. Lawrence Livermore National Lab., CA (United States). Dec 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410155–6-Pt.2: 26. annual symposium on optical materials for high power lasers: Boulder damage symposium, Boulder, CO (United States), 24-26 Oct 1994). Order Number DE95014536. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have reported extensive measurements of damage thresholds for fused silica and several fluorides (LiF, CaF, MgF, and BaF) at 1053 and 526 nm for pulse durations, τ, ranging from 275 fs to 1 ns. A theoretical model based on electron production via multiphoton ionization, Joule heating, and collisional (avalanche) ionization is in good agreement with experimental results.

24921 (UCRL-JC–118517) **Review of hohlraum coupling.** Kauffman, R.L. Lawrence Livermore National Lab., CA (United States). 30 Jan 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409226–9: ECLIM 23: laser interaction with matter, Oxford (United Kingdom), 19-23 Sep 1994). Order Number DE95014368. Source: OSTI; NTIS; INIS; GPO Dep.

Extensive experiments have been done to characterize laser-heated hohlraum targets for indirect drive inertial fusion. Scattered light and fast electrons from laser-plasma instabilities have been found not to be significant for short wavelength light. Scaling of radiation temperature with laser power has been studied at several Laboratories and can be represented by a simple power balance scaling for experiments using short wavelength light. Measurements of x-ray production and energy loss in hohlraum walls have been made to study details of the power balance model.

24922 (UCRL-JC–118523) **National Ignition Facility design, performance, and cost.** Hogan, W.J. (and others); Paisner, J.A.; Lowdermilk, W.H. Lawrence Livermore National Lab., CA (United States). 16 Sep 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409226–8: ECLIM 23: laser interaction with matter, Oxford (United Kingdom), 19-23 Sep 1994). Order Number DE95011766. Source: OSTI; NTIS; GPO Dep.

A conceptual design for the National Ignition Facility (NIF) has been completed and its cost has been estimated by a multilaboratory team. To maximize the performance/cost ratio a compact, segmented amplifier is used in a multipass architecture. Many recent optical and laser technology developments have been incorporated into the final design. The Beamlet project has successfully demonstrated the new concept. The mission of ICF Program using the NEF is to achieve ignition and gain in the laboratory. The facility will be used for defense applications such as weapons physics and weapons effects experiments, and for civilian applications such as inertial fusion energy development and fundamental studies of matter at high energy density.

24923 (UCRL-JC–118837) **Diagnostics for the detection and evaluation of laser induced damage.** Sheehan, L.; Kozlowski, M.; Rainer, F. Lawrence Livermore National Lab., CA (United States). 3 Jan 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410155–7: 26. annual symposium on optical materials for high power lasers: Boulder damage symposium, Boulder, CO (United States), 24-26 Oct 1994). Order Number DE95014517. Source: OSTI; NTIS; INIS; GPO Dep.

The Laser Damage and Conditioning Group at LLNL is evaluating diagnostics which will help make damage testing more efficient and reduce the risk of damage during laser conditioning. The work to date has focused on photoacoustic and scattered light measurements on 1064-nm wavelength HfO_2/SiO_2 multilayer mirror and

polarizer coatings. Both the acoustic and scatter diagnostics have resolved 10 μm diameter damage points in these coatings. Using a scanning stage, the scatter diagnostic can map both intrinsic and laser-induced scatter. Damage threshold measurements obtained using scatter diagnostics compare within experimental error with those measured using 100x Nomarski microscopy. Scatter signals measured during laser conditioning can be used to detect damage related to nodular defects.

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24924 (CONF-9505221–1) **Adventures in Supercomputing: An innovative program.** Summers, B.G.; Hicks, H.R.; Oliver, C.E. Oak Ridge National Lab., TN (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Dual-use technologies and applications conference; Utica, NY (United States); 22-25 May 1995. Order Number DE95013202. Source: OSTI; NTIS; GPO Dep.

Within the realm of education, seldom does an innovative program become available with the potential to change an educator's teaching methodology and serve as a spur to systemic reform. The Adventures in Supercomputing (AiS) program, sponsored by the Department of Energy, is such a program. Adventures in Supercomputing is a program for high school and middle school teachers. It has helped to change the teaching paradigm of many of the teachers involved in the program from a teacher-centered classroom to a student-centered classroom. "A student-centered classroom offers better opportunities for development of internal motivation, planning skills, goal setting and perseverance than does the traditional teacher-directed mode". Not only is the process of teaching changed, but evidences of systemic reform are beginning to surface. After describing the program, the authors discuss the teaching strategies being used and the evidences of systemic change in many of the AiS schools in Tennessee.

24925 (DOE/BP–2504) **Hydromania: Summer science camp curriculum.** USDOE Bonneville Power Administration, Portland, OR (United States). [1995]. 168p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014449. Source: OSTI; NTIS; GPO Dep.

In 1992, Bonneville Power Administration (BPA) and the US Department of Energy (DOE) began a collaborative pilot project with the Portland Parks and Recreation Community Schools Program and others to provide summer science camps to children in Grades 4–6. Camps run two weeks in duration between late June and mid-August. Sessions are five days per week, from 9 a.m. to 3 p.m. In addition to hands-on science and math curriculum, at least three field trips are incorporated into the educational learning experience. The purpose of the BPA/DOE summer camps is to make available opportunities for fun, motivating experiences in science to students who otherwise would have difficulty accessing them. This includes inner city, minority, rural and low income students. Public law 101-510, which Congress passed in 1990, authorizes DOE facilities to establish collaborative inner-city and rural partnership programs in science and math. A primary goal of the BPA summer hands on science camps is to bring affordable science camp experiences to students where they live. It uses everyday materials to engage students' minds and to give them a sense that they have succeeded through a fun hands-on learning environment.

24926 (DOE/ER/75665–2) **DOE/EPSCoR Traineeship Program: Progress report, academic year 1992–93. Annual report 1993.** Hodgson, D.; Steadman, J. Wyoming Univ., Laramie, WY (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75665. Order Number DE95015506. Source: OSTI; NTIS; GPO Dep.

This progress report reviews the University of Wyoming's approach to implementing the DOE Traineeship Program, and briefly describes the research performed by the DOE/EPSCoR Trainees during the academic year, 1992–1993. These brief descriptions of individual research projects demonstrate the wide scope of energy-related research that the DOE-EPSCoR Traineeships have initiated in Wyoming. The availability of this funding has encouraged many talented students to continue their education in fields of interest to DOE. These additional bright, energetic graduate students have improved the educational atmosphere for everyone. The visibility of the DOE program has sharpened the focus of the science and engineering departments on the energy-related research of importance to Wyoming and DOE. The impact of the DOE Traineeships in Wyoming has been substantial and very positive. It has not only increased the number of students studying in energy-related disciplines, but has also increased the quality of their graduate research. The program has also increased the visibility of DOE in Wyoming and has helped focus attention on the energy and environmental graduate education which is so essential to the University and the State.

24927 (DOE/ER/75665–3) **DOE/EPSCoR Traineeship Program: Final report, 1994.** Gern, W.; Steadman, J. Wyoming Univ., Laramie, WY (United States). [1994]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75665. Order Number DE95015588. Source: OSTI; NTIS; GPO Dep.

This report reviews the University of Wyoming's approach to implementing the DOE Traineeship Program, and briefly describes the research performed by the DOE/EPSCoR Trainees during Years 2 and 3 of the Traineeship Program, 1992–1994, as of August 1994. These brief descriptions of individual research projects demonstrate the wide scope of energy-related research that the DOE-EPSCoR Traineeships have initiated in Wyoming. The availability of this funding has encouraged many talented students to continue their education in fields of interest to DOE. These additional graduate students have improved the educational atmosphere for everyone. The visibility of the DOE program has sharpened the focus of the science and engineering departments on the energy-related research of importance to Wyoming and DOE. The impact of the DOE Traineeships in Wyoming has been substantial and very positive. It has not only increased the number of students studying in energy-related disciplines, but has also increased the quality of their graduate research. The program has also increased the visibility of DOE in Wyoming and has helped focus attention on the energy and environmental graduate education which is so essential to the University and the State.

24928 (DOE/SR/18048–4) **Student Science Enrichment Training Program.** Sandhu, S.S. Claflin Coll., Orangeburg, SC (United States). [1990]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-88SR18048. Order Number DE95014981. Source: OSTI; NTIS; GPO Dep.

Funds are requested for the science enrichment training program (emphasis on chemistry and computer science), which will be held at Claflin College during the 1990 and 1991 summers, concomitant with summer school. The thirty participants will include high school students and some college freshmen; the students will come from rural South Carolina schools with limited science and computer facilities. Focus will be on high ability minority students.

24929 (SAND–95-0348C) **Human factors in agile manufacturing.** Forsythe, C. Sandia National Labs., Albuquerque, NM (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951092–1: Human Factors and Ergonomics Society meeting, San Diego, CA (United States), 9-13 Oct 1995). Order Number DE95007740. Source: OSTI; NTIS; GPO Dep.

As industries position themselves for the competitive markets of today, and the increasingly competitive global markets of the 21st century, agility, or the ability to rapidly develop and produce new products, represents a common trend. Agility manifests itself in many different forms, with the agile manufacturing paradigm proposed by the Iacocca Institute offering a generally accepted, long-term vision. In its many forms, common elements of agility or agile manufacturing include: changes in business, engineering and production practices, seamless information flow from design through production, integration of computer and information technologies into all facets of the product development and production process, application of communications technologies to enable collaborative work between geographically dispersed product development team members and introduction of flexible automation of production processes. Industry has rarely experienced as dramatic an infusion of new technologies or as extensive a change in culture and work practices. Human factors will not only play a vital

role in accomplishing the technical and social objectives of agile manufacturing. but has an opportunity to participate in shaping the evolution of industry paradigms for the 21st century.

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Refer also to citation(s) 23270, 23317, 23357, 23359, 23682, 23794, 24412

24930 (BNL–52447) **Brookhaven highlights 1994.** Brookhaven National Lab., Upton, NY (United States). [1994]. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE95013317. Source: OSTI; NTIS; INIS; GPO Dep.

Established in 1947 on Long Island, New York, on the site of the former army Camp Upton, BNL is a multidisciplinary laboratory that carries out basic and applied research in the physical, biomedical and environmental sciences and in selected energy technologies. The Laboratory is managed by Associated Universities, Inc., under contract to the US Department of Energy. BNL's annual budget is about $400 million, and the Laboratory's facilities are valued at replacements cost in excess of over $2.8 billion. Employees number around 3,300,and over 4,000 guests, collaborators and students come each year to use the Laboratory's facilities and work with the staff. Scientific and technical achievements at BNL have made their way into daily life in areas as varied as health care, construction materials and video games. The backbone of these developments is fundamental research, which is and always will be an investment in the future.

24931 (CONF-9410190–Absts.) **18th Annual TRADE Conference: Abstracts.** Oak Ridge Associated Universities, Inc., TN (United States). [1994]. 207p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. From 18. annual training resources and data exchange conference: meeting line management expectations; Dallas, TX (United States); 31 Oct - 2 nov 1994. Order Number DE95010551. Source: OSTI; NTIS; GPO Dep.

This document consists of abstracts, authors, and author's business addresses from the 1994 annual Training Resources and Data Exchange (TRADE) conference. A wide variety of training mechanisms and media are presented on an even wider variety of topics.

24932 (DOE/EM–0240) **Cost Quality Management Assessment for the Idaho Operations Office. Final report.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Office of Engineering and Cost Management. Jun 1995. 151p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014140. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Engineering and Cost Management (EM-24) conducted a Cost Quality Management Assessment of EM-30 and EM-40 activities at the Idaho National Engineering Laboratory on Feb. 3–19, 1992 (Round I). The CQMA team assessed the cost and cost-related management activities at INEL. The Round II CQMA, conducted at INEL Sept. 19–29, 1994, reviewed EM-30, EM-40, EM-50, and EM-60 cost and cost-related management practices against performance objectives and criteria. Round II did not address indirect cost analysis. INEL has made measurable progress since Round I.

24933 (DOE/IG–0374) **Audit of the Department of Energy's Commercial Laboratory Quality Assurance Evaluation Program.** USDOE Office of Inspector General, Washington, DC (United States). Capital Regional Audit Office. Jun 1995. 17p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge).

The Department of Energy (Department), through its contractors, contracts with commercial analytical laboratories for the analysis of samples related to environmental management activities and worker health and safety programs. Over 100 commercial laboratories located throughout the United States perform sample analyses for the Department, Because of problems identified during previous audit work, we initiated our audit to determine whether the Department's commercial laboratory quality assurance evaluation program was effective and efficient.

24934 (DOE/NV/11432–181) **Qualitative validation of emergency response procedures.** Francis, A.A. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Jun 1995. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-94NV11432. Order Number DE95014556. Source: OSTI; NTIS; GPO Dep.

Emergency managers have come to recognize that there is a quintessential style of emergency response procedure development that must be guarded against. This style allows the definition of objectives to be decided upon apart from the problems posed by their implementation, and then permits the brushing aside of such obstacles as mere tactical problems to be dealt with once goals have been clarified. If permitted to pervade emergency management policy-making, this "can do" spirit will grow steadily more confused and complex each step of the way. Instead of plowing bravely ahead in the confident belief that a formidable array of talent and resources will overcome any obstacle, intuitive managers periodically pause and take inventory of accumulated liabilities and difficulties associated with their emergency response procedures. This work suggests use of the extreme value analysis principle in conjunction with time/loss analysis as the inventory tool to gauge the effectiveness of procedures in the response phase, or amelioration process, of an incident.

24935 (DOE-TSL–1-95) **Department of Energy Standards Index.** USDOE Assistant Secretary for Nuclear Energy, Washington, DC (United States). Office of Nuclear Safety Policy and Standards. Aug 1995. 77p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015401. Source: OSTI; NTIS; GPO Dep.

This TSL, intended for use in selecting and using DOE technical standards and other Government and non-Government standards, provides listing of current and inactive DOE technical standards, non-Government standards adopted by DOE, other Government documents in which DOE has a recorded interest, and cancelled DOE technical standards.

24936 (DOE-TSL–4-95) **Directory of DOE and contractor personnel involved in non-government standards activities.** USDOE, Washington, DC (United States). Aug 1995. 157p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95015703. Source: OSTI; NTIS; GPO Dep.

This document contains a listing of DOE employees and DOE contractors who have submitted form DOE F 1300.2, Record of Non-Government Standards Activity. Additional names were added from rosters supplied by non-Government standards bodies.

24937 (JAERI-Review–95-002) **Annual report of the Osaka Laboratory for Radiation Chemistry Japan Atomic Energy Research Institute, (No. 27). April 1, 1993 - March 31, 1994.** Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 68p. Order Number DE95789323. Source: OSTI; NTIS; INIS.

The annual research activities of Osaka Laboratory for Radiation Chemistry, JAERI during the fiscal year of 1993 (April 1, 1993 - March 31, 1994) are described. The research activities were conducted under the two research programs; the study on laser-induced organic chemical reactions and the study on basic radiation technology for functional materials. Detailed descriptions of the activities are presented in the following subjects: laser-induced organic synthesis, modification of polymer surface by laser irradiation, radiation-induced polymerization, preparation of fine particles by gamma ray irradiation, and electron beam dosimetry. The operation report of the irradiation facilities is also included. (author).

24938 (LA-SUB–95-36-Vol.1) **[Trip report of travel to Las Vegas to consider specification for the Integrated Data System (IDS) with administrative memos]. Volume 1, FY92–FY93.** Hall, J. (Computer Applications Group, Inc., Carlton, OR (United States)). Lawrence Livermore National Lab., CA (United States); Computer Applications Group, Inc., Carlton, OR (United States). 15 Dec 1994. 336p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95013476. Source: OSTI; NTIS; GPO Dep.

This document is a compilation of travel reports and memorandums that are the results of planning between Los Alamos National Laboratory and Computer Applications Group, Inc.

24939 (LBL-PUB–5409) **Lawrence Berkeley Laboratory FY 1995 site development plan.** Lawrence Berkeley Lab., CA (United States). 14 Apr 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE95011277. Source: OSTI; NTIS; GPO Dep.

This report is a site development plan detailing the mission of LBL, its workload and site population, program projections and requirements, master plans, and management considerations.

24940 (RFP–4902) **10 CFR 830.120 Criterion 10, Independent Assessment: We're here to help you!.** Farrell, R.E. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1995]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. (CONF-950601–15: Annual meeting of the American Nuclear Society (ANS), Philadelphia, PA (United States), 25-29 Jun 1995). Order Number DE95014003. Source: OSTI; NTIS; INIS; GPO Dep.

Each organization performing activities in the DOE Weapons Complex is required to have an pendent assessment function. This is consistent from DOE Order 5700.6C, Quality Assurance to 10 CFR 830-120, sometimes referred to as the Price-Anderson rule. DOE Order 5700.6C, Criterion 10 Independent Assessment requires, " Planned and periodic independent assessments shall be conducted to measure item quality and process effectiveness and to promote improvement. The organization performing independent assessments shall have sufficient authority and freedom from the line organization to carry out its responsibilities. Persons conducting independent assessments shall be technically qualified and knowledgeable in the areas assessed." 10 CFR 830.120, (c) Quality assurance criteria – (3) Assessment – (ii) Independent Assessment requires,"Independent assessments shall be planned and conducted to measure item and service quality, to measure the adequacy of work performance, and to promote improvement. The group performing independent assessments shall have sufficient authority and freedom from the line to carry out its responsibilities. Persons conducting independent assessments shall be technically qualified and knowledgeable in the areas assessed."

24941 (SAND–94-2328/1) **Research methods to develop measures of effectiveness of the United States Coast Guard's Vessel Inspection and Boarding Program, Volume 1 - executive summary.** Wheeler, T. (Sandia National Labs., Albuquerque, NM (United States)); Cox, R.; Gawande, K. Sandia National Labs., Albuquerque, NM (United States). Apr 1995. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014530. Source: OSTI; NTIS; GPO Dep.

The primary objective of this study is to provide Measures of Effectiveness (MOEs) of the U.S. Coast Guard Marine Inspection and Boarding Program based on objective scientific methods. A secondary objective of the study is to provide USCG management with a methodologically and theoretically sound aid to effective policy decision-making. The MOEs constructed in this study are specific to the Marine Inspection and Boarding Program, but the methodology of the study is based on sound theoretical principles that are probably applicable to a range of USCG activities. Hence the methodology applies equally to other important USCG programs and can be similarly used to measure their effectiveness and as an aid to decision-making.

24942 (SAND–95-0328C) **Selecting a risk-based tool to aid in decision making.** Bendure, A.O. Sandia National Labs., Albuquerque, NM (United States). [1995]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950740–68: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95007737. Source: OSTI; NTIS; GPO Dep.

Selecting a risk-based tool to aid in decision making is as much of a challenge as properly using the tool once it has been selected. Failure to consider customer and stakeholder requirements and the technical bases and differences in risk-based decision making tools will produce confounding and/or politically unacceptable results when the tool is used. Selecting a risk-based decisionmaking tool must therefore be undertaken with the same, if not greater, rigor than the use of the tool once it is selected. This paper presents a process for selecting a risk-based tool appropriate to a set of prioritization or resource allocation tasks, discusses the results of applying the process to four risk-based decision-making tools, and identifies the "musts" for successful selection and implementation of a risk-based tool to aid in decision making.

24943 (SAND–95-0845) **The vital issues process: Strategic planning for a changing world.** Engi, D.; Glicken, J. Sandia National Labs., Albuquerque, NM (United States). May 1995. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95012529. Source: OSTI; NTIS; GPO Dep.

The Vital Issues process (VIp) is a strategic planning tool initially developed by Sandia National Laboratories (SNL) for the Office of Foreign Intelligence (OFI)" of the US Department of Energy (DOE). It was further developed and refined through its application to a variety of strategic purposes for a range of public and semipublic organizations. The VIp provides a structured mechanism for assisting organizations in accomplishing specified objectives by identifying and prioritizing a portfolio of strategic issues, programmatic areas, or responses to a specified problem. It employs day-long panel meetings in a specified format to elicit a broad range of perspectives on a particular issue in a nonconfrontational manner and to facilitate the interaction and synthesis of diverse viewpoints on a specific topic. The VIp is unique in its incorporation of two primary approaches in each panel session: a qualitative or transactional segment, which entails the synthesis of the alternatives through negotiations or discussion, and a quantitative or net benefit maximization segment, an analytical approach, which involves prioritization of the alternatives using pairwise comparisons. This combination of facilitated group discussion and quantitative ranking provides input to strategic management decisions in the form of stakeholder-defined and -prioritized items as well as information on potential barriers to the implementation of policies and programs. This is the final volume in the series Identifying Vital Issues: New Intelligence Strategies for a New World, a three-volume set that gives an accounting of the VIp as implemented for OFI. This volume provides an in-depth description of the methodology used in the VIp.

24944 (SAND–95-0908C) **Communicating in a multi-project environment with a single-sheet project plan.** Furaus, J.P.; Figueroa-McInteer, C.; Glidewell, D.D.; McKeever, P.S.; Hendrick, W.E.; Wisler, D.B.; Zavadil, J.T. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9510171–2: PMI '95: Project Management Institute conference, New Orleans, LA (United States), 13-19 Oct 1995). Order Number DE95013887. Source: OSTI; NTIS; GPO Dep.

In June 1992, the Corporate Construction Program Office was formed to provide single-point accountability for managing all corporate-sponsored construction projects at Sandia, answering to upper Sandia management as well as Sandia's primary external customer, the U.S. DOE. CCPO had 3 major areas of responsibility: Congressional line-item projects (>$2 million), general plant projects (<$2 million), and corporate-funded major rearrangements (renovations). A single-sheet project plan ("summary sheet"), with monthly updates, was developed for every project. Each month, the sheets are duplicated and placed in a "project summary book" that is distributed through various communication channels at Sandia. Despite many modifications, the summary sheet has remained simple and useful to a broad range of project stakeholders. This paper describes how the sheet's design and implementation enhances communication across Sandia's complex, multi-program environment.

24945 (SAND–95-0937) **1994 Ergonomics Program Quality Evaluation.** Longbotham, L.; Miller, D.P. Sandia National Labs., Albuquerque, NM (United States). Jun 1995. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95015439. Source: OSTI; NTIS; GPO Dep.

A telephone survey was conducted to evaluate the quality of service provided to the primary customers of the Corporate Ergonomics Group (CEG). One hundred clients who received services between October 1993 and June 1994 were asked questions

on their expectations, implementation of ergonomic recommendations, follow-ups, time required, productivity improvements, symptom alleviation, and satisfaction. Suggestions on how processes could be improved were also solicited. In general, recommendations are being implemented, worksite evaluations are going smoothly, and customers are satisfied with the process. The CEG was pleased to learn that half of the people who implemented recommendations experienced improvements in productivity, and four out of five symptomatic customers experienced partial or complete relief. Through analysis of the data and by studying clients' suggestions for process improvement, the CEG has developed a strategy for changing and improving current procedures and practices. These plans can be found in the last section of this report.

24946 (SAND–95-0942C) **Power of a shared vision.** Furaus, J.P.; Baca, A.M.; Corbett, D.W.; Everett, J.J.; Faturos, T.V.; Harrison, S.J.; Hartzell, R.; Lucero, F.C. Jr.; Oliver, P. Sandia National Labs., Albuquerque, NM (United States). [1995]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9510171–3: PMI '95: Project Management Institute conference, New Orleans, LA (United States), 13-19 Oct 1995). Order Number DE95014853. Source: OSTI; NTIS; GPO Dep.

Management activities and ideas at Sandia National Laboratories are presented. Jim Jacobs provided a firm foundation for facilities management from 1991 to 1993 by organizing the following three entities: the program management center, the facilities development center, and the operations and maintenance center. The continuance of these three streamlining mechanisms and an emphasis on program councils dictated by Neil Hartwigsen ensure an efficiently run Laboratory. Plans and results are described.

24947 (SSCL-SR–1217) **Superconducting Super Collider site environmental report for calendar year 1991. Pre-operational.** Superconducting Super Collider Lab., Dallas, TX (United States). [1995]. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE95011209. Source: OSTI; NTIS; INIS; GPO Dep.

This is the first annual SER prepared for the SSC project. It is a pre-operational report, intended primarily to describe the baseline characterization of the Ellis County, Texas site that has been developed subsequent to the Environmental Impact Statement (EIS) and the Supplemental Environmental impact Statement (SEIS). As such, the emphasis will be on environmental compliance efforts, including monitoring and mitigation programs. The SER also reports on the measures taken to meet the commitments made in the EIS and SEIS. These measures are detailed in the Mitigation Action Plan (MAP) (Department of Energy (DOE), 1991), which was prepared following the signing of the Record of Decision (ROD) to construct the SSC in Texas. The SER will continue to be preoperational until the first high-energy (20 trillion electron volt or TeV) protons collisions are observed, at which point the SSC will become operational. At that time, the SER will place more emphasis on the radiological monitoring program. This SER will report on actions taken in 1991 or earlier and briefly mention some of those planned for calendar year 1992. AU actions completed in 1992 will be addressed in the SER for calendar year 1992.

24948 (UCRL-ID–116187-94-10) **The Mixed Waste Management Facility monthly report, October 1994.** Streit, R. Lawrence Livermore National Lab., CA (United States). Nov 1994. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013308. Source: OSTI; NTIS; GPO Dep.

During October, significant progress was made on both the management and technical activities of the Project. These activities were accomplished within the scope and effort described in the MWMF FY95 Plan (currently in draft within the Project), which reflects the reduced DOE FY95 funding guidance received September 29, 1994. DOE/OAK approved Revision 1 of the MWMF Baseline (reflecting KD-1 guidance), thus providing a basis for Revision 2 (reflecting DWTF/MWW integration). Considerable management and senior-engineering resources were directed toward addressing the issues that are summarized below. The proposed technical scope and schedule for the FY95 Plan was largely completed during October, along with consistent (but less detailed) tasks and estimates for the remainder of the project; this latter information will also be used as a basis for the Rebaseline. However, the FY95 Plan cannot be finalized until mid-November when LLNL tax rates will be established. MWMF project personnel completed most of the input and draft documentation required by the LLNL permitting group to prepare the modified RD&D permit application that reflects the DWTF/MWMF integration. The PSAR continued through the LLNL approval chain. Revisions to the EA began to reflect the DWTF/MWMF integration. Two significant reviews of the project were addressed: the DOE Office of the Inspector General (OIG) and the Options Analysis Team (OAT). Draft documents were prepared and discussed with DOE/OAK and HQ to provide for a coordinated response.

24949 (WHC-SD-GN-CSWD–30077) **Hanford Action Tracking System release planning support documents.** Keasling, R. Westinghouse Hanford Co., Richland, WA (United States). 5 May 1995. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95012584. Source: OSTI; NTIS; GPO Dep.

This document contains impacts, plans, resource requirements, schedules, and documents to ensure the conduct of activities for the operation of the Hanford Action Tracking System (HATS). Each discrete topic in this document applies to a specific area of management and team interaction. These formally establish the planning, resources, documentation, and training responsibilities for the system management team. This document is composed of four appendices. These include the following: (1) organization impacts and implementation plan–expected organizational impacts resulting from setting up the new support system for the HATS, the plan to address each of these impacts and other system implementation requirements; (2) training and information requirements–training and information needed to use and operate the HATS; (3) operation/maintenance resources–resources required to maintain and operate the HATS once the system becomes operations; (4) training package–HATS implementation training needs, includes a training procedure, the environment for training users (tools and materials required for the facility, trainer, and trainee); schedule, and handout materials and forms to be completed at the time of training.

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Refer also to citation(s) 23047, 23048, 23055, 23064, 23078, 23088, 23121, 23232, 23235, 23236, 23309, 23415, 23467, 23478, 23497, 23521, 23524, 23555, 23564, 23566, 23574, 23581, 23612, 23632, 23634, 23639, 23640, 23641, 23705, 23718, 23731, 23734, 23736, 23763, 23764, 23767, 23774, 23801, 23812, 23817, 23850, 23867, 23875, 23929, 23973, 23976, 23977, 23978, 23993, 23994, 23997, 24002, 24005, 24009, 24012, 24013, 24022, 24023, 24024, 24025, 24031, 24032, 24093, 24108, 24137, 24185, 24224, 24254, 24292, 24357, 24360, 24381, 24385, 24391, 24405, 24406, 24409, 24432, 24435, 24455, 24464, 24466, 24467, 24469, 24522, 24535, 24548, 24552, 24592, 24593, 24617, 24649, 24697, 24704, 24708, 24709, 24737, 24741, 24751, 24752, 24756, 24770, 24777, 24827, 24828, 24832, 24833, 24847, 24863, 25020, 25033

24950 (ANL/CHM/CP–86617) **Parallel computing in quantum chemistry – Message passing and beyond for a general ab initio program system.** Lischka, H. (Univ. of Vienna (Austria). Inst. fuer Theoretische Chemie und Strahlenchemie); Dachsel, H.; Shepard, R.; Harrison, R.J. Argonne National Lab., IL (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States);Fund for Advancement of Scientific Research in Austria (Austria). DOE Contract W-31109-ENG-38. Project P9032. (CONF-940301–48: 207. spring national meeting of the American Chemical Society (ACS), San Diego, CA (United States), 13-18 Mar 1994). Order Number DE95013463. Source: OSTI; NTIS; GPO Dep.

One of the most prominent aims in Computational Chemistry is the modeling of chemical reactions and the prediction of molecular properties. Quantum chemical methods are used for the calculation of molecular structures, spectra, reaction energy profiles and many other interesting quantities. Nowadays, the accuracy of the theoretical calculations can compete to an increasing extent with the experimental one. A great variety of quantum chemical methods

exist ranging from the standard Hartree-Fock theory to sophisticated electron correlation approaches. From a computational point of view all these methods require rather lengthy and complicated program codes and have to handle a large amount of data to be stored on external devices. In the simplest case, the Hartree-Fock (SCF) method, "direct" algorithms have eliminated the I/O and storage bottleneck and have opened the way to parallel implementations. For post-Hartree-Fock methods the situation is much more complicated as will be demonstrated below. Therefore, most of the previous attempts in parallelizing quantum chemical ab initio programs concentrated on SCF methods. The authors investigations presented here are a continuation of their previous work on the parallelization of the COLUMBUS program system. The COLUMBUS program is based on the multireference single- and double-excitation configuration interaction (MRSDCI) approach. It is very portable and runs on a large variety of computers including numerous Unix-based workstations, VAX/VMS minicomputers, IBM mainframes and Cray supercomputers.

24951 (ANL/EA/CP–86212) **A simplified model to estimate radiological doses from incineration of radioactive waste.** Stevens, L.E. (USDOE, Washington, DC (United States)); Ma, C.W.; Wheeler, T.; Nimmagadda, M.; LePoire, D.; Chen, S.Y.; Owens, K.W. Argonne National Lab., IL (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950542–1: 14. international symposium on thermal treatment technologies: incineration conference, Seattle, WA (United States), 8-12 May 1995). Order Number DE95013413. Source: OSTI; NTIS; INIS; GPO Dep.

A simplified calculational model permits a rapid yet realistic estimate of small, but potential radiological doses to onsite workers and the offsite public as a result of transportation, handling, storage, incineration, and maintenance of waste containing trace amount of radioactive materials which is to be processed at a treatment, storage, and disposal (TSD) facility. The model was developed on the basis of previous detailed studies of eight TSD facilities and builds in the essential features of a TSD facility. The model would provide an understanding of the potential human exposure associated with the radioactive contents in the chemical wastes.

24952 (ANL/MCS/CP–86036) **An introduction to performance debugging for parallel computers – fast.** Gropp, W. Argonne National Lab., IL (United States). 7 Feb 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9405327–1: ICASE/LaRC workshop on parallel numerical algorithms, Norfolk, VA (United States), 23-25 May 1994). Order Number DE95013383. Source: OSTI; NTIS; GPO Dep.

Programming parallel computers for performance is a difficult task that requires careful attention to both single-node performance and data exchange between processors. This paper discusses some of the sources of poor performance, ways to identify them in an application, and a few ways to address these issues.

24953 (ANL/MCS/CP–86446) **Automatic differentiation: Obtaining fast and reliable derivatives – fast.** Bischof, C.H. (Argonne National Lab., IL (United States). Mathematics and Computer Science Div.); Khademi, P.M.; Pusch, G.; Carle, A. Argonne National Lab., IL (United States). [1994]. 17p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Agreement NCCW-0027; Agreement CCR-9120008. (CONF-9407190–1: SIAM symposium on control problems in industry, San Diego, CA (United States), 22-23 Jul 1994). Order Number DE95014244. Source: OSTI; NTIS; GPO Dep.

In this paper, the authors introduce automatic differentiation as a method for computing derivatives of large computer codes. After a brief discussion of methods of differentiating codes, they review automatic differentiation and introduce the ADIFOR (Automatic DIfferentiation of FORtran) tool. They highlight some applications of ADIFOR to large industrial and scientific codes (groundwater transport, CFD airfoil design, and sensitivity-enhanced MM5 mesoscale weather model), and discuss the effectiveness and performance of their approach. Finally, they discuss sparsity in automatic differentiation and introduce the SparsLinC library.

24954 (ANL/MCS/CP–86648) **An interactive virtual environment for finite element analysis.** Bradshaw, S. (Argonne National Lab., IL (United States). Mathematics Computer Science Div.); Canfield, T.; Kokinis, J.; Disz, T. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950431–3: High performance computing '95, Tucson, AZ (United States), 9-13 Apr 1995). Order Number DE95013441. Source: OSTI; NTIS; GPO Dep.

Virtual environments (VE) provide a powerful human-computer interface that opens the door to exciting new methods of interaction with high-performance computing applications in several areas of research. The authors are interested in the use of virtual environments as a user interface to real-time simulations used in rapid prototyping procedures. Consequently, the authors are developing methods for coupling finite element models of complex mechanical systems with a VE interface for real-time interaction.

24955 (ANL/MCS-TM–195) **Using ADIFOR 1.0 to compute Hessians.** Hovland, P. Argonne National Lab., IL (United States). Apr 1995. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE95014521. Source: OSTI; NTIS; GPO Dep.

Technical Memorandum Number 195.

ADIFOR provides a simple means to produce code for the first derivatives of functions through the technique of automatic differentiation. However, the fact that ADIFOR currently cannot produce code to compute second derivatives limits its usefulness for certain applications. This paper describes how ADIFOR and related tools can be used to produce code that does compute second derivatives and discusses how to use this code. Conclusions are presented about the limitations of this method and how it might compare with second-derivative code produced directly by ADIFOR.

24956 (ANL/MCS-TM–207) **Users manual for tohtml: Producing true hypertext documents from LaTeX.** Gropp, W. Argonne National Lab., IL (United States). Mar 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. Order Number DE95012980. Source: OSTI; NTIS; GPO Dep.

The World Wide Web has made it possible to—use and disseminate documents as "hypertext." One of the major advantages of hypertext over conventional text is that references to other documents or items can be linked directly into the document, allowing the easy retrieval of related information. A collection of documents can also be read this way, jumping from one document to another based on the interests of the reader. This does require that the hypertext documents be extensively cross-linked. Unfortunately, most existing documents are designed as linear documents. Even worse, most authors still think of documents as linear structures, to be read from front to back. To deal with this situation, a number of tools have been created that take documents in an existing word-processing system or markup language and generate "HTML," the hypertext markup language used on the Web. While this process makes a single document available in a convenient form on the Web, it does not give access to cross-document linking, a major advantage of hypertext. This manual describes a program, tohtml, that takes LaTeX input files, as well as files of link information, and produces a hypertext document that can contain extensive cross-links. A related program, doctext, aids in the generation of manual pages that can be referenced by a LaTeX document.

24957 (ANL/RE/CP–86223) **Enrichment of the finite element method with reproducing kernel particle method.** Chen, Y. (Northwestern Univ., Evanston, IL (United States). Mechanical Engineering Dept.); Liu, W.K.; Uras, R.A. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950740–55: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95014248. Source: OSTI; NTIS; GPO Dep.

Based on the reproducing kernel particle method on enrichment procedure is introduced to enhance the effectiveness of the finite element method. The basic concepts for the reproducing kernel particle method are briefly reviewed. By adopting the well-known completeness requirements, a generalized form of the reproducing

kernel particle method is developed. Through a combination of these two methods their unique advantages can be utilized. An alternative approach, the multiple field method is also introduced.

24958 (ANL/RE/CP–86314) **On mesh rezoning algorithms for parallel platforms.** Plaskacz, E.J. Argonne National Lab., IL (United States). [1995]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-950740–58: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95014243. Source: OSTI; NTIS; GPO Dep.

A mesh rezoning algorithm for finite element simulations in a parallel-distributed environment is described. The cornerstones of the algorithm are: the parallel computation of distortion norms on the element and subdomain level, the exchange of the individual subdomain norms to form a subdomain distortion vector, the classification of subdomains and the rezoning behavior prescribed within each subdomain as a response to its own classification and the classification of neighboring subdomains.

24959 (ANL/RE/CP–86315) **Structural mechanics computations on parallel computing platforms.** Kulak, R.F.; Plaskacz, E.J.; Pfeiffer, P.A. Argonne National Lab., IL (United States). [1995]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-950740–53: Joint ASME/JSME pressure vessels and piping conference, Honolulu, HI (United States), 23-27 Jul 1995). Order Number DE95013520. Source: OSTI; NTIS; INIS; GPO Dep.

With recent advances in parallel supercomputers and network-connected workstations, the solution to large scale structural engineering problems has now become tractable. High-performance computer architectures, which are usually available at large universities and national laboratories, now can solve large nonlinear problems. At the other end of the spectrum, network connected workstations can be configured to become a distributed-parallel computer. This approach is attractive to small, medium and large engineering firms. This paper describes the development of a parallelized finite element computer program for the solution of static, nonlinear structural mechanics problems.

24960 (CONF-9410335–, pp. 10-15) **What is computational intelligence?** Bezdek, J.C. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

This not is about neural-like computational networks, numerical pattern recognition and intelligence. Its purpose is to record my ideas about the notions of computational, artificial and biological intelligence, and the semantics we use to describe them. Perhaps a dialog about the term "intelligent systems" will guide us towards rational expectations about models that try to mimic this aspect of human behavior.

24961 (CONF-9410335–, pp. 16-37) **Foundations of neural networks.** Simpson, P.K. (General Dynamics Electronics Division, San Diego, CA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Building intelligent systems that can model human behavior has captured the attention of the world for years. So, it is not surprising that a technology such as neural networks has generated great interest. This paper will provide an evolutionary introduction to neural networks by beginning with the key elements and terminology of neural networks, and developing the topologies, learning laws, and recall dynamics from this infrastructure. The perspective taken in this paper is largely that of an engineer, emphasizing the application potential of neural networks and drawing comparisons with other techniques that have similar motivations. As such, mathematics will be relied upon in many of the discussions to make points as precise as possible. The paper begins with a review of what neural networks are and why they are so appealing. A typical neural network is immediately introduced to illustrate several of the key features. With this network as a reference, the evolutionary introduction to neural networks is then pursued. The fundamental elements of a neural network, such as input and output patterns, processing element, connections, and threshold operations, are described, followed by descriptions of neural network topologies, learning algorithms, and recall dynamics. A taxonomy of neural networks is presented that uses two of the key characteristics of learning and recall. Finally, a comparison of neural networks and similar nonneural information processing methods is presented.

24962 (CONF-9410335–, pp. 38-50) **Nonlinear PLS modeling using neural networks.** Qin, S.J. (Univ. of Maryland, College Park, MD (United States)); McAvoy, T.J. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

This paper discusses the embedding of neural networks into the framework of the PLS (partial least squares) modeling method resulting in a neural net PLS modeling approach. By using the universal approximation property of neural networks, the PLS modeling method is genealized to a nonlinear framework. The resulting model uses neural networks to capture the nonlinearity and keeps the PLS projection to attain robust generalization property. In this paper, the standard PLS modeling method is briefly reviewed. Then a neural net PLS (NNPLS) modeling approach is proposed which incorporates feedforward networks into the PLS modeling. A multi-input-multi-output nonlinear modeling task is decomposed into linear outer relations and simple nonlinear inner relations which are performed by a number of single-input-single-output networks. Since only a small size network is trained at one time, the over-parametrized problem of the direct neural network approach is circumvented even when the training data are very sparse. A conjugate gradient learning method is employed to train the network. It is shown that, by analyzing the NNPLS algorithm, the global NNPLS model is equivalent to a multilayer feedforward network. Finally, applications of the proposed NNPLS method are presented with comparison to the standard linear PLS method and the direct neural network approach. The proposed neural net PLS method gives better prediction results than the PLS modeling method and the direct neural network approach.

24963 (CONF-9410335–, pp. 51-56) **Nonlinear principal components analysis–based on principal curves and neural networks.** Dong, D. (Univ. of Maryland, College Park, MD (United States)); McAvoy, T.J. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Many applications of principal component analysis (PCA) can be found in recently published papers. But principal component analysis is a linear method, and most engineering problems are nonlinear. Sometimes using the linear PCA method in nonlinear problems can bring distorted and misleading results. So there is a need for a nonlinear principal component analysis (NLPCA) method. The principal curve algorithm was a breakthrough of solving the NLPCA problem, but the algorithm does not yield an NLPCA model which can be used for predictions. In this paper we

present a NLPCA method which integrates the principal curve algorithm and neural networks. The results on both simulated and real problems show that the method is excellent for solving nonlinear principal component problems. Potential applications of NLPCA are also discussed in this paper.

24964 (CONF-9410335–, pp. 57-65) **Soft computing and fuzzy logic.** Zadeh, L.A. (Univ. of California, Berkeley, CA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. Grant NCC-2-275; Grant RP 8010-34. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Soft computing is a collection of methodologies that aim to exploit the tolerance for imprecision and uncertainty to achieve tractability, robustness, and low solution cost. Its principal constituents are fuzzy logic, neuro-computing, and probabilistic reasoning. Soft computing is likely to play an increasingly important role in many application areas, including software engineering. The role model for soft computing is the human mind.

24965 (CONF-9410335–, pp. 66-75) **Fuzzy logic controllers: From development to deployment.** Bonissone, P.P. (General Electric Corporate R&D, Schenectady, NY (United States)); Chiang, K.H. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

We view fuzzy logic control technology as a high level language in which we can efficiently define and synthesize non-linear controllers for a given process. We contrast fuzzy Proportional Integral (PI) controllers with conventional PI and two dimensional sliding mode controllers. Then we compare the development of Fuzzy Logic Controllers (FLC) with that of Knowledge Based System (KBS) applications. We decompose the comparison into reasoning tasks (representation, inference, and control) and application tasks (acquisition, development, validation, compilation, and deployment). After reviewing the reasoning tasks, we focus on the compilation of fuzzy rule bases into fast access lookup tables. These tables can be used by a simplified run-time engine to determine the TLC's crisp output for a given input.

24966 (CONF-9410335–, pp. 76-91) **Industrial Applications of Fuzzy Logic at General Electric.** Bonissone, P.P. (General Electric Corporate Research and Development, Schenectady, NY (United States)); Badami, V.; Chiang, K.H.; Khedkar, P.S.; Marcelle, K.W.; Schutten, M.J. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. Contract RP8004-25. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Fuzzy Logic Control (FLC) technology has drastically reduced the development time and deployment cost for the synthesis of nonlinear controllers for dynamic systems. As a result we have experienced an increased number of FLC applications. We will illustrate some of our efforts in FLC technology transfer, covering projects in turboshaft aircraft engine control, steam turbine startup, steam turbine cycling optimization, resonant converter power supply control, and data-induced modeling of the nonlinear relationship between process variables in a rolling mill stand. We will compare these applications in a cost/complexity framework, and examine the driving factors that led to the use of FLCs in each application. We will emphasize the role of fuzzy logic in developing supervisory controllers and in maintaining explicit tradeoff criteria used to manage multiple control strategies. Finally, we will describe some of our FLC technology research efforts in automatic rule base tuning and generation, leading to a suite of programs for reinforcement learning, supervised learning, genetic algorithms, steepest descent algorithms, and rule clustering.

24967 (CONF-9410335–, pp. 92-101) **Overview of exploratory research in adaptive control systems at the Electric Power Research Institute.** Wildberger, A.M. (Electric Power Research Institute, Palo Alto, CA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Exploratory Research in Adaptive Control Systems at the Electric Power Research Institute (EPRI) attempts to combine the goal of finding innovative and valuable applications specific to the electric power industry with the equally important goal of establishing fundamental theory or reliable procedures for the design and development of adaptive and intelligent systems. The largest block of this research consists of twenty-one projects that make up the "Intelligent Control Systems (ICS) Initiative," jointly funded by EPRI and the National Science Foundation (NSF). Most of these projects began in 1993 and will continue for three years. The rest of EPRI's Exploratory Research projects, that address adaptive control in general, are part of the program in Applied Mathematics and Information Science (AM&IS). This area emphasizes fundamental theory and design procedures. However, the AM&IS program also includes projects that seek to invent and test new techniques and new applications whose success appears relatively risky at the beginning of the project.

24968 (CONF-9410335–, pp. 102-116) **EPA's adaptive controls system research program for pollution prevention and clean technologies.** Spiegel, R.J. (Environmental Protection Agency, Research Triangle Park, NC (United States)); Chappell, P.J.; Miller, C.A. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

The current effort of EPA's control systems research is concentrated in three areas: electric motors, wind turbines, and combustion technologies. In general, these projects are concerned with pollution prevention through enhanced efficiency of operation and pollution control through lower emission levels. Pioneering effort has been achieved in the application of fuzzy-logic-based controls in these areas. Based on the results of these projects, fuzzy logic has emerged as an important tool in environmental technology for pollution elimination and control.

24969 (CONF-9410335–, pp. 117-148) **Genetic Algorithms: A gentle introduction.** Jong, K.D. (George Mason Univ., Fairfax, VA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Information is presented on genetic algorithms in outline form. The following topics are discussed: how are new samples

generated, a genotypic viewpoint, a phenotypic viewpoint, an optimization viewpoint, an intuitive view, parameter optimization problems, evolving production rates, genetic programming, GAs and NNs, formal analysis, Lemmas and theorems, discrete Walsh transforms, deceptive problems, Markov chain analysis, and PAC learning analysis.

24970 (CONF-9410335–, pp. 149-152) **Genetic algorithms.** Grefenstette, J.J. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Genetic algorithms solve problems by using principles inspired by natural population genetics: They maintain a population of knowledge structures that represent candidate solutions, and then let that population evolve over time through competition and controlled variation. GAs are being applied to a wide range of optimization and learning problems in many domains.

24971 (CONF-9410335–, pp. 153-158) **Test and evaluation by genetic algorithms.** Schultz, A.C.; Grefenstette, J.J.; Jong, K.A. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Autonomous vehicles will require sophisticated software controllers. Given a vehicle simulation and an intelligent controller for that vehicle, what methods are available for testing the controller's robustness? Validation and verification are enough: The controller might perform as specified, but the specifications could be incorrect; that is, the vehicle might not behave as expected. Testing all possible situations is obviously intractable. And techniques for testing isolated, low-level controllers do not apply to the vehicle as a whole. Also, traditional controller tests are labor intensive and time consuming. Some methods require simulated vehicle missions to test the controller's robustness under various conditions. After designing a fault scenario that will cause particular failures during a simulated mission, the test engineers observe the vehicle's resulting behavior and then refine the fault scenario to better exercise the controller. This cycle is repeated until the engineers are confident that the vehicle's behavior will be appropriate in the field. Implicitly, the engineers are searching for interesting fault scenarios.

24972 (CONF-9410335–, pp. 159-165) **First flights of genetic-algorithm Kitty Hawk.** Goldberg, D.E. (Univ. of Illinois, Urbana, IL (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

The design of complex systems requires an effective methodology of invention. This paper considers the methodology of the Wright brothers in inventing the powered airplane and suggests how successes in the design of genetic algorithms have come at the hands of a Wright-brothers-like approach. Recent reliable subquadratic results in solving hard problems with nontraditional GAs and predictions of the limits of simple GAs are presented as two accomplishments achieved in this manner.

24973 (CONF-9410335–, pp. 166-171) **Strategy for adaptive process control for a column flotation unit.** Karr, C.L.; Ferguson, C.R. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Researchers at the U.S. Bureau of Mines (USBM) have developed adaptive process control systems in which genetic algorithms (GAs) are used to augment fuzzy logic controllers (FLCs). Together, GAs and FLCs possess the capabilities necessary to produce powerful, efficient, and robust adaptive control systems. To perform efficiently, such control systems require a control element to manipulate the problem environment, an analysis element to recognize changes in the problem environment, and a learning element to adjust to the changes in the problem environment. In this paper, the details of an ongoing research effort to develop and implement an adaptive process control system for a column flotation unit are discussed. Column flotation units are used extensively in the mineral processing industry to recover valuable minerals from their ores.

24974 (CONF-9410335–, pp. 172-185) **Assuring the performance of adaptive control systems.** Wildberger, A.M. (Electric Power Research Institute, Palo Alto, CA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

Assuring the stability, robustness and completeness of any control system is difficult enough, but if the system includes any form of artificial intelligence that allows it to adapt or learn while it is operating, such assurance creates new, and perhaps unsolvable, problems. This paper examines some of the theoretical and practical bases underlying these problems and discusses some current research directed toward overcoming them. One pragmatic approach attempts to automate a guaranteed optimal design and/or automate post-design testing by the use of evolutionary programming and genetic algorithms. Ideally, it would be preferable to provide formal proofs and quantitative design criteria similar to those available for linear feedback control systems. Ultimately, the complete solution of these problems may require new mathematical developments in the area of non-additive measure theory, non-linear dynamics, and the understanding of complexity and adaptation in general.

24975 (CONF-9410335–, pp. 186-212) **Fuzzy models for pattern recognition.** Bezdek, J.C.; Sankar K. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

FUZZY sets were introduced in 1965 by Lotfi Zadeh as a new way to represent vagueness in everyday life. They are a generalization of conventional set theory, one of the basic structures underlying computational mathematics and models. Computational pattern recognition has played a central role in the development of fuzzy models because fuzzy interpretations of data structures are a very natural and intuitively plausible way to formulate and solve various problems. Fuzzy control theory has also provided a wide variety of real, fielded system applications of fuzzy technology. We shall have little more to say about the growth of fuzzy models in control, except to the extent that pattern recognition algorithms and methods described in this book impact control systems. Collected here are many of the seminal papers in the field. There will be, of

course, omissions that are neither by intent nor ignorance; we cannot reproduce all of the important papers that have helped in the evolution of fuzzy pattern recognition (there may be as many as five hundred) even in this narrow application domain. We will attempt, in each chapter introduction, to comment on some of the important papers that not been included and we ask both readers and authors to understand that a book such as this simply cannot "contain everything." Our objective in Chapter 1 is to describe the basic structure of fuzzy sets theory as it applies to the major problems encountered in the design of a pattern recognition system.

24976 (CONF-9410335–, pp. 213-221) **Application of neural networks for control of chaotic systems.** Mulpur, A. (Visual Solutions, Inc., Westford, MA (United States)); Mulpur, S. USDOE Pittsburgh Energy Technology Center, PA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science; Naval Research Lab., Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); Bureau of Mines, Washington, DC (United States). [1994]. From Adaptive control systems technology symposium; Pittsburgh, PA (United States); 24-25 Oct 1994. In *High-tech controls for energy and environment. Proceedings.* 287p. Order Number DE95011702. Source: OSTI; NTIS; GPO Dep.

This paper investigates the feasibility of alternative and more general ways to control nonlinear and chaotic systems, based on Artificial Neural Networks (ANN). A chaotic system model is considered and a neural network is trained to serve as an intelligent controller for the system. During the training phase, a conventional controller is used as the teacher. The neural controller is placed in the closed loop after the training phase. Simulation results indicate that the neural net controller performs satisfactorily, compared to conventional closed-loop controllers.

24977 (CONF-9410337–1) **An MPI version of the BLACS.** Walker, D.W. Oak Ridge National Lab., TN (United States). [1994]. 19p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. DAAL03-91-C-0047. From Scalable parallel libraries conference; Starksville, MS (United States); 12-14 Oct 1994. Order Number DE95010291. Source: OSTI; NTIS; GPO Dep.

In this paper, issues related to implementing an MPI version of the Basic Linear Communication Subprograms (BLACS) are investigated. A set of routines, the MPI Linear Algebra Communication Subprograms (MLACS), are presented, and these arc used to implement an MPI version of the BLACS, The MLACS provide the same functionality as the BLACS, but extend the functionality of the BLACS to include both blocking and nonblocking communication, and all four of the MPI communication modes.

24978 (CONF-950534–4) **Virtual laboratories: Collaborative environments and facilities-on-line.** Thomas, C.E. Jr. (Oak Ridge National Lab., TN (United States). I and C Div.); Cavallini, J.S.; Seweryniak, G.R.; Kitchens, T.A.; Hitchcock, D.A.; Scott, M.A.; Welch, L.C.; Aiken, R.J. Oak Ridge National Lab., TN (United States). [1995]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Conference on real-time computer applications in nuclear, particle and plasma physics (RT); East Lansing, MI (United States); 22-26 May 1995. Order Number DE95014596. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) has major research laboratories in a number of locations in the US, typically co-located with large research instruments or research facilities valued at tens of millions to even billions of dollars. Present budget exigencies facing the entire nation are felt very deeply at DOE, just as elsewhere. Advances over the last few years in networking and computing technologies make virtual collaborative environments and conduct of experiments over the internetwork structure a possibility. The authors believe that development of these collaborative environments and facilities-on-line could lead to a "virtual laboratory" with tremendous potential for decreasing the costs of research and increasing the productivity of their capital investment in research facilities. The majority of these cost savings would be due to increased productivity of their research efforts, better utilization of resources and facilities, and avoiding duplication of expensive facilities. A vision of how this might all fit together and a discussion of the infrastructure necessary to enable these developments is presented.

24979 (DOE/ER/25138–T1) **The use of symbolic computation in radiative, energy, and neutron transport calculations. Technical report, 15 August 1992–14 August 1994.** Frankel, J.I. Florida Inst. of Tech., Melbourne, FL (United States). Dept. of Mechanical and Aerospace Engineering. [1995]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-92ER25138. Order Number DE95013078. Source: OSTI; NTIS; INIS; GPO Dep.

This investigation uses symbolic computation in developing analytical methods and general computational strategies for solving both linear and nonlinear, regular and singular, integral and integro-differential equations which appear in radiative and combined mode energy transport. This technical report summarizes the research conducted during the first nine months of the present investigation. The use of Chebyshev polynomials augmented with symbolic computation has clearly been demonstrated in problems involving radiative (or neutron) transport, and mixed-mode energy transport. Theoretical issues related to convergence, errors, and accuracy have also been pursued. Three manuscripts have resulted from the funded research. These manuscripts have been submitted to archival journals. At the present time, an investigation involving a conductive and radiative medium is underway. The mathematical formulation leads to a system of nonlinear, weakly-singular integral equations involving the unknown temperature and various Legendre moments of the radiative intensity in a participating medium. Some preliminary results are presented illustrating the direction of the proposed research.

24980 (DOE/ET/53088–689) **Exactly conservative integrators.** Shadwick, B.A.; Bowman, J.C.; Morrison, P.J. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. 19 Jul 1995. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. Order Number DE95015448. Source: OSTI; NTIS; GPO Dep.

Traditional numerical discretizations of conservative systems generically yield an artificial secular drift of any nonlinear invariants. In this work we present an explicit nontraditional algorithm that exactly conserves invariants. We illustrate the general method by applying it to the Three-Wave truncation of the Euler equations, the Volterra-Lotka predator-prey model, and the Kepler problem. We discuss our method in the context of symplectic (phase space conserving) integration methods as well as nonsymplectic conservative methods. We comment on the application of our method to general conservative systems.

24981 (ENEA-RT-AMB–94-22) **Analceos software for analysis of ERS-1 altimeter data: implementation of new module to extract data from selected area.** Lisca, A. (ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute); Vignudelli, S. ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute. Sep 1994. 72p. Order Number DE95789769. Source: OSTI; NTIS (US Sales Only).

The present technical report reviews the characteristics of the ERS-1 altimeter and the different products provided by ESA (European Space Agency). It also describes altimeter data format stored on CD-Rom support. Additionally, the Analceos software package, written in the C language, is explained in detail; this latter was originally developed by M. Menez at IFREMER-CERSAT and permits the analysis of the CD-Rom logical structure where off-line LBR (low bit rate) products are stored in compliance with the CEOS (Committee on Earth Observation Satellites). The authors have solved the problem of porting the above program to the DEC Risc-Ultrix platform and have developed a C language module linked to Analceos that permits a user to select a working area through geographical coordinates (latitude, longitude). The output is a directory containing ASCII orbit files of tracks crossing the selected area. The report is mainly oriented towards specialists who want to analyse ESA products.

24982 (ESTSC–000805SPARC00) **SANDOSE. Sandia Total Dose Estimator Using Mass Sectoring of 3-D CAD Models.** Turner, C.D. (Sandia National Labs., Albuquerque, NM (United

States)); Ackermann, M. R. Sandia National Labs., Albuquerque, NM (United States). 1 Sep 1994. Sponsored by USDOE, Washington, DC (United States). Source: ESTSC.

Description: SUN SPARC; SunOS4.1x (UNIX); C, X-windows, SUN DevGuide (for graphical use interface); 1 3.5 Diskette. BRL-CAD is required to utilize SANDOSE, along with SUN DevGuide Software Libraries for the graphical user interface.

SANDOSE is an optional module for the Ballistic Research Laboratory CAD (BRL-CAD) package, Release 4.0 [1]. BRL-CAD is a moderately-advanced primitive-based, solid-modeling package which is available (including source code) from the Ballistic Research Laboratory. The purpose of SANDOSE is to estimate total radiation dose at specific locations in a BRL-CAD model. The radiation source is assumed to be omnidirectional. The code is integrated directly into the BRL-CAD solid model editor and is operated using a simple graphical user interface. Several diagnostic tools are available to allow the user to analyze the results, including graphical, color-coded intensity displays of sector rays. These displays are useful for qualitative analysis of shielding alternatives. Any model created using BRL-CAD can be analyzed with SANDOSE.

24983 (ESTSC–000895MLTPL00) **BLOCKSOLVE. Scalable Library for the Parallel Solution of Sparse Linear Systems.** Jones, M. (Argonne National Lab., IL (United States)); Plassmann, P. Argonne National Lab., IL (United States). 1 Mar 1993. Sponsored by USDOE, Washington, DC (United States). Source: ESTSC.

Description: MLT-PLTFM; Intel NX and Unix; it is largelyC; 1 3.5 Diskette.

BlockSolve is a scalable parallel software library for the solution of large sparse, symmetric systems of linear equations. It runs on a variety of parallel architectures and can easily be ported to others. BlockSovle is primarily intended for the solution of sparse linear systems that arise from physical problems having multiple degrees of freedom at each node point. For example, when the finite element method is used to solve practical problems in structural engineering, each node will typically have anywhere from 3-6 degrees of freedom associated with it. BlockSolve is written to take advantage of problems of this nature; however, it is still reasonably efficient for problems that have only one degree of freedom associated with each node, such as the three-dimensional Poisson problem. It does not require that the matrices have any particular structure other than being sparse and symmetric. BlockSolve is intended to be used within real application codes. It is designed to work best in the context of our experience which indicated that most application codes solve the same linear systems with several different right-hand sides and/or linear systems with the same structure, but different matrix values multiple times.

24984 (ESTSC–001048IBMPC00) **AF-500+DRIVER. Eaton AF5000+Genesis Communication Driver.** Eldridge, K. (CalMax, Inc, Spokane, WA (United States)). EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations. 12 May 1993. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-93NV11265. Source: ESTSC.

Description: IBM PC; Software driver compiled with MiMicrosoft C Compiler version 5.1 w/Iconics Driver Development Kit library header files.; 1 3.5 Diskette. To implement driver with Gensis software, a graphic configuration environment is used to select points for communications. Driver files must be copied into the directory where the Genesis system files reside.

Communication driver allows the Genesis Control Series software to interact with Eaton AF5000+ frequency drives via RS-232 communications. All Eaton AF5000+ parameters that support communications are supported by the Genesis driver. Multidrop addressing to multiple units is available with the Genesis communication driver.

24985 (ESTSC–001050SUN0000) **EDEN. Holographic Methods in X-ray Crystallography.** Szoke, A. (Lawrence Livermore National Lab., CA (United States)). Lawrence Livermore National Lab., CA (United States). 1 Apr 1993. Sponsored by USDOE, Washington, DC (United States). Source: ESTSC.

Description: SUN; UNIX; FORTRAN; 1 Mag Tape.

The holographic method makes use of partially modeled electron density and experimentally-measured structure factor amplitudes to recover electron density corresponding to the unmodeled part of a crystal structure. This paper describes a fast algorithm that makes it possible to apply the holographic method to sizable crystallographic problems. The algorithm uses positivity constraints on the electron density, and can incorporate a target electron density, making it similar to solvent flattening. Using both synthetic and experimental data, we assess the potential for applying the holographic method to macromolecular x-ray crystallography.

24986 (FNAL–TM-1934) **Design notes for the next generation persistent object manager for CAP.** Isely, M. (and others); Fischler, M.; Galli, M. Fermi National Accelerator Lab., Batavia, IL (United States). May 1995. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE95014550. Source: OSTI; NTIS; INIS; GPO Dep.

The CAP query system software at Fermilab has several major components, including SQS (for managing the query), the retrieval system (for fetching auxiliary data), and the query software itself. The central query software in particular is essentially a modified version of the 'ptool' product created at UIC (University of Illinois at Chicago) as part of the PASS project under Bob Grossman. The original UIC version was designed for use in a single-user non-distributed Unix environment. The Fermi modifications were an attempt to permit multi-user access to a data set distributed over a set of storage nodes. (The hardware is an IBM SP-x system - a cluster of AIX POWER2 nodes with an IBM-proprietary high speed switch interconnect). Since the implementation work of the Fermized ptool, the CAP members have learned quite a bit about the nature of queries and where the current performance bottlenecks exist. This has lead them to design a persistent object manager that will overcome these problems. For backwards compatibility with ptool, the ptool persistent object API will largely be retained, but the implementation will be entirely different.

24987 (INIS-mf–14544) **Transport process of digital simulation in hydraulic environmental engineering: direct and inverse problems analysis through an unidimensional model.** Suarez Antola, R. (Direccion Nacional de Tecnologia Nuclear, Montevideo (Uruguay)); Rodriguez Bojorja, F.; Lacues, E.; Alvarez, W. Ministerio de Industria, Energia y Mineria, Montevideo (Uruguay). Direccion Nacional de Tecnologia Nuclear; Universidad de la Republica, Montevideo (Uruguay). Facultad de Ingenieria. [1995]. 18p. (In Spanish). Order Number DE95632489. Source: OSTI; NTIS (US Sales Only); INIS.

Pre conference.

Mathematical model methods for impact evaluation environment were applied in the chemical effluent concentration time value.

24988 (INIS-mf–14546) **Digital simulation of an enrichment process for solutions by means of an advection-diffusion chamber.** Artucio, G. (Nuclear Technology National Direction (Uruguay)); Suarez, R. Ministerio de Industria, Energia y Mineria, Montevideo (Uruguay). Direccion Nacional de Tecnologia Nuclear; Universidad Catolica del Uruguay, Montevideo (Uruguay). [1995]. 13p. (In Spanish). Order Number DE95632490. Source: OSTI; NTIS (US Sales Only); INIS.

An ab-initio digital simulation of the space-time dynamics of the concentration field of a solute in an advection-diffusion chamber is done. Some questions related to the digital simulation of the concentration field using the analytical solution obtained in a previous paper are discussed.

24989 (INIS-mf–14547) **Sequential method for the assessment of innovations in computer assisted industrial processes.** Suarez Antola, R. (Universidad Catolica del Uruguay, Montevideo (Uruguay)); Artucio, G. Universidad Catolica del Uruguay, Montevideo (Uruguay); Ministerio de Industria, Energia y Mineria, Montevideo (Uruguay). Direccion Nacional de Tecnologia Nuclear. [1995]. 18p. (In Spanish). Order Number DE95632491. Source: OSTI; NTIS (US Sales Only); INIS.

A sequential method for the assessment of innovations in industrial processes is proposed, using suitable combinations of mathematical modelling and numerical simulation of dynamics. Some advantages and limitations of the proposed method are discussed. tabs.

24990 (JAERI-Data/Code–95-001) **MCVIEW2: a radiation view factor computer program for three dimensional geometries using Monte Carlo method.** Ikushima, Takeshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 68p. Order Number DE95789303. Source: OSTI; NTIS; INIS.

FORTRAN-77/FACOM M-780.

The computer program MCVIEW2, which is a revised version of MCVIEW, has been developed for calculation of radiation view factors between surfaces for three dimensional geometries. The main revisions of the computer program are as follows: (1) the alteration of algorithms of making the random numbers for the non-computer dependent, (2) the alteration of input data format from the free format to the fixed format. In the paper, brief illustration of calculation method using the Monte Carlo for view factors is presented in the second section. The third section presents comparisons between view factors of various methods such as the area integration method, the line integration method, the cross string method and the Monte Carlo method, concerning with the calculation errors and the computer execution time. The fourth section provides an user's guide for MCVIEW2. (author).

24991 (JAERI-Tech–95-014) **Development of animation processing system.** Kato, Katsumi (Nuclear Energy Data Center, Tokai, Ibaraki (Japan)); Watanabe, Tadashi; Machida, Masahiko; Kaburaki, Hideo. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1995. 48p. (In Japanese). Order Number DE95789299. Source: OSTI; NTIS; INIS.

Computer and network environment for image processing has been developed and maintained by the computing and information systems center under the course of establishing a distributed processing environment. A server workstation was introduced for image processing. An animation processing system, in which simulation results are consecutively visualized on the server workstation and automatically recorded on a video tape, has been developed. In this report, a system construction, visualization in the workstation using a visualization tool, control of video tape recorder and workstation, and production of animation video are described with some examples. (author).

24992 (JINR-D–13-92-581, pp. 149-151) **Low-DAD3D integrated system for data acquisition and processing.** Nikiforov, A.S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The LOW-DAD3D software for data acquisition and data processing from CAMAC modules is presented. It consists of program packages LOW and DAD3D. Both of them have easy-to-use environments for the user. The LOW package organizes data acquisition from CAMAC modules. Data read out by LOW are transferred to the DAD3D package for accumulation, data processing, analysis and presentation in the graphic form. This software allows one to decrease the time of testing CAMAC modules for high energy physical spectrometers. 1 ref.; 2 figs.

24993 (JINR-D–13-92-581, pp. 152-156) **Structure of software for automation system of spectrometric experiments by means of data bases.** Korneev, D.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Lyapin, D.I.; Ostrovnoj, A.I.; Salamatin, I.M.; Chelnokov, M.L.; Chernenko, L.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The data base is proposed as the central element for avoiding the gap between the acquisition and processing programs, combining the programs into unified complex. The structure of software for automation system of spectrometric experiments with application of the data base is considered by the example of the SPN program complex, developed at the LNF OIYal. The complex makes it possible to accomplish the data acquisition from detectors, their storage at the data base and preliminary processing and control over the spectrometer and CAMAC apparatus state in the course of the data acquisition. 3 refs.; 1 fig.

24994 (JINR-D–13-92-581, pp. 172-176) **Fastbus 64-digital input register with buffer memory.** Parfenov, A.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The FASTBUS-F6588 modulus constituting an input register with subsequent rerecording of the registered data into the buffer memory is developed for increasing the number of measuring channels. The modulus provides also for the possibility of assigning the time delay between the moment of the data recording start and the trigger signal. The input data recording and readout schemes are presented. 2 refs.; 2 figs.

24995 (JINR-D–13-92-581, pp. 260-272) **Generators for testing of spectrometric units performance.** Kuznetsov, A.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

Special generators for testing timing and amplitude characteristics of spectrometric units are described. The amplitude generator is accomplished in the CAMAC standard on the basis of the miniature KMP-M mercuric gercon with the shifting time of less than 500 μs. The possibility of the pulse amplitude programmed control is envisaged in the generator. Except analogous outlet the generator is provided for three timing outlets corresponding to the interval of linear gateways strobing. The basic characteristics of tested generators are presented. 6 refs.; 2 figs.

24996 (LA-SUB–95-77) **Using the force to write parallel HEP programs.** Jordan, H.F. Los Alamos National Lab., NM (United States). [1995]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE95014566. Source: OSTI; NTIS; GPO Dep.

The basic idea behind using the force method of parallel programming is to write a program (a force) which can be executed by any number of processes, including one process. The fork into parallel processes is done before the force is ever executed and the number of processes can be chosen on the basis of hardware efficiency only. Experience indicates that it is not hard to write programs which are independent of the number of executing processes on a shared-memory MIMD computer. Several such applications programs have been written for the HEP computer in HEP Fortran 77, which is standard Fortran 77 with very rudimentary parallel extensions. The constructs which seemed to be useful in these programs were formalized into a set of statements which can be macro-expanded into HEP Fortran 77. Some essential ideas to keep in mind when writing a force is that each statement is executed by all processes of the force unless an explicit synchronization prevents this. The distinction between a local variable, which has a separate memory cell assigned for each process referencing it, and a global variable, which has one memory cell which is used by all processes, is important to keep straight. There are force constructs which make it easy to specify that a section of code is to be executed by only one process. Other constructs specify that the body of a loop is to be executed for all values of the loop index in parallel with one process handling each index value. Unless explicit force statements prevent it, a call is executed by all processes so that subroutines executed by all processes of the force are also possible.

24997 (LA-UR–95-1169) **Parallel sphere rendering.** Krogh, M. (Los Alamos National Lab., NM (United States)); Hansen, C.;

Painter, J.; de Verdiere, G.C. Los Alamos National Lab., NM (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9510137–1: Parallel rendering symposium, Atlanta, GA (United States), 24 Oct 1995). Order Number DE95010882. Source: OSTI; NTIS; GPO Dep.

Sphere rendering is an important method for visualizing molecular dynamics data. This paper presents a parallel divide-and-conquer algorithm that is almost 90 times faster than current graphics workstations. To render extremely large data sets and large images, the algorithm uses the MIMD features of the supercomputers to divide up the data, render independent partial images, and then finally composite the multiple partial images using an optimal method. The algorithm and performance results are presented for the CM-5 and the T3D.

24998 (LA-UR–95-1223) **Interval neural networks.** Patil, R.B. Los Alamos National Lab., NM (United States). [1995]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9503135–3: APIC '95, El Paso, TX (United States), Mar 1995). Order Number DE95012077. Source: OSTI; NTIS; GPO Dep.

Traditional neural networks like multi-layered perceptrons (MLP) use example patterns, i.e., pairs of real-valued observation vectors, $(\vec{x}, \vec{y})$, to approximate function $\hat{f}(\vec{x}) = \vec{y}$. To determine the parameters of the approximation, a special version of the gradient descent method called back-propagation is widely used. In many situations, observations of the input and output variables are not precise; instead, we usually have intervals of possible values. The imprecision could be due to the limited accuracy of the measuring instrument or could reflect genuine uncertainty in the observed variables. In such situation input and output data consist of mixed data types; intervals and precise numbers. Function approximation in interval domains is considered in this paper. We discuss a modification of the classical backpropagation learning algorithm to interval domains. Results are presented with simple examples demonstrating few properties of nonlinear interval mapping as noise resistance and finding set of solutions to the function approximation problem.

24999 (LBL–37206) **Impulse-based methods for fluid flow.** Cortez, R. Lawrence Berkeley Lab., CA (United States). May 1995. 105p. Sponsored by USDOE, Washington, DC (United States);California Univ., Berkeley, CA (United States);Department of Defense, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant FDF49620-93-1-0053. Order Number DE95014792. Source: OSTI; NTIS; GPO Dep.

A Lagrangian numerical method based on impulse variables is analyzed. A relation between impulse vectors and vortex dipoles with a prescribed dipole moment is presented. This relation is used to adapt the high-accuracy cutoff functions of vortex methods for use in impulse-based methods. A source of error in the long-time implementation of the impulse method is explained and two techniques for avoiding this error are presented. An application of impulse methods to the motion of a fluid surrounded by an elastic membrane is presented.

25000 (ORNL/M–4316) **Additional verification problems for HEATING 7.2.** Park, J.E. Oak Ridge National Lab., TN (United States). Jun 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95013791. Source: OSTI; NTIS; GPO Dep.

First estimates of heat transfer coefficients from the quenches at Torrington and IITRI were presented on December 1, 1994, at NCMS. Some of the calculated values were negative. Several suggestions have been made as to the cause of this clearly physically unrealistic result. In this first portion of a systematic investigation of the problem, the thermal analysis code HEATING 7.2 is used to solve two possibly relevant demonstration problems.

25001 (ORNL/TM–12988) **A note on seven analogous properties between Stirling numbers of the first kind and binomial coefficients.** Wright, T. Oak Ridge National Lab., TN (United States). Jun 1995. 11p. Sponsored by National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE95014464. Source: OSTI; NTIS; GPO Dep.

This brief report gives seven analogous properties between Stirling numbers of the first kind and binomial coefficients.

25002 (PNL-SA–23600) **TEMPEST: A computer code for three-dimensional analysis of transient fluid dynamics.** Fort, J.A. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95015802. Source: OSTI; NTIS; INIS; GPO Dep.

TEMPEST (Transient Energy Momentum and Pressure Equations Solutions in Three dimensions) is a powerful tool for solving engineering problems in nuclear energy, waste processing, chemical processing, and environmental restoration because it analyzes and illustrates 3-D time-dependent computational fluid dynamics and heat transfer analysis. It is a family of codes with two primary versions, a N- Version (available to public) and a T-Version (not currently available to public). This handout discusses its capabilities, applications, numerical algorithms, development status, and availability and assistance.

25003 (PNL-SA–24715) **Global arrays: A portable "shared-memory" programming model for distributed memory computers.** Harrison, R.J.; Nieplocha, J.; Littlefield, R.J. Pacific Northwest Lab., Richland, WA (United States). Nov 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-941118–11: Supercomputing '94 meeting, Washington, DC (United States), 14-18 Nov 1994). Order Number DE95014622. Source: OSTI; NTIS; GPO Dep.

Portability, efficiency, and ease of coding are all important considerations in choosing the programming model for a scalable parallel application. The message-passing programming model is widely used because of its portability, yet some applications are too complex to code in it while also trying to maintain a balanced computation load and avoid redundant computations. The shared-memory programming model simplifies coding, but it is not portable and often provides little control over interprocessor data transfer costs. This paper describes a new approach, called Global Arrays (GA), that combines the better features of both other models, leading to both simple coding and efficient execution. The key concept of GA is that it provides a portable interface through which each process in a MIMD parallel program can asynchronously access logical blocks of physically distributed matrices, with no need for explicit cooperation by other processes. The authors have implemented GA libraries on a variety of computer systems, including the Intel DELTA and Paragon, the IBM SP-1 (all message-passers), the Kendall Square KSR-2 (a nonuniform access shared-memory machine), and networks of Unix workstations. They discuss the design and implementation of these libraries, report their performance, illustrate the use of GA in the context of computational chemistry applications, and describe the use of a GA performance visualization tool.

25004 (PNL-SA–24972) **A tool for promoting pollution prevention in facility design.** Greitzer, F.L. (and others); Brown, B.W.; Dorsey, J.A. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-950451–5: 21. national environmental symposium and exhibition, San Diego, CA (United States), 17-21 Apr 1995). Order Number DE95014173. Source: OSTI; NTIS; GPO Dep.

The Pacific Northwest Laboratory[a] has developed a tool to assist in incorporating pollution prevention opportunities into the design of federal facilities. The pollution prevention electronic design guideline (EDG), developed for the U.S. Department of Energy (DOE), contains a database of 267 opportunities intended to help a decisionmaker (designer, engineer, or project manager) evaluate the applicability and potential benefits of implementing pollution prevention in a particular project. The EDG's database was derived from both DOE and non-DOE sources including pollution prevention literature, industrial design personnel, and federal, state, and DOE sources. A key feature of the tool is the integration of photos, illustrations, and documentation to provide easy access to technical information on specific waste minimization opportunities in design. This paper describes the software tool, the Pollution Prevention Electronic Design Guideline (EDG). The EDG runs on a personal computer within the Microsoft Windows environment. The EDG is

used with the P2DA Guidance Manual on a project-by-project basis. The P2DA process is analogous to the Waste Minimization Assessment method established by the U.S. Environmental Protection Agency for existing process waste streams. The EDG is introduced during the stage of the P2DA when design alternatives are being explored (after the anticipated waste streams have been quantified). As such, the EDG database is not exhaustive, and it is not computational (i.e., it does not compute the lifecycle impacts of implementation). Its purpose is to raise awareness of existing technologies and design practices that can improve resource efficiency or decrease waste generation over the entire life of the project (construction, operation, and decommissioning), and to provide a template for the documentation. Because design is an iterative process, the EDG is also intended to be revisited with each successive design stage.

25005 (PNL-SA–25715) **A programmable Fortran preprocessor.** Rosing, M. Pacific Northwest Lab., Richland, WA (United States). Jun 1995. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9506208–1: ACM sigplan conference on programming language design and implementation, La Jolla, CA (United States), 18-21 Jun 1995). Order Number DE95014196. Source: OSTI; NTIS; GPO Dep.

A programmable Fortran preprocessor is described. It allows users to define compile time operations that can examine and modify the source tree before it is compiled with a traditional compiler. This intermediate step allows the definition of routines and operations that adapt to the context in which they are used. Context sensitive operations increase the flexibility of abstractions that can be built without degrading efficiency, as compared to using traditional run time based abstractions such as libraries or objects. The preprocessor is described briefly along with an example of how it is used to add CMFortran array operations to Fortran77. Other preprocessors that have been implemented are also briefly described.

25006 (PNL-SA–26072) **Human-computer interface design.** Bowser, S.E. Pacific Northwest Lab., Richland, WA (United States). Apr 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9504185–1: Software technology conference, Salt Lake City, UT (United States), 9-14 Apr 1995). Order Number DE95014607. Source: OSTI; NTIS; GPO Dep.

Modern military forces assume that computer-based information is reliable, timely, available, usable, and shared. The importance of computer-based information is based on the assumption that "shared situation awareness, coupled with the ability to conduct continuous operations, will allow information age armies to observe, decide, and act faster, more correctly and more precisely than their enemies." (Sullivan and Dubik 1994). Human-Computer Interface (HCI) design standardization is critical to the realization of the previously stated assumptions. Given that a key factor of a high-performance, high-reliability system is an easy-to-use, effective design of the interface between the hardware, software, and the user, it follows logically that the interface between the computer and the military user is critical to the success of the information-age military. The proliferation of computer technology has resulted in the development of an extensive variety of computer-based systems and the implementation of varying HCI styles on these systems. To accommodate the continued growth in computer-based systems, minimize HCI diversity, and improve system performance and reliability, the U.S. Department of Defense (DoD) is continuing to adopt interface standards for developing computer-based systems.

25007 (PNL-SA–26086) **Use of GIS in the Federal Emergency Management Information System (FEMIS).** Tzemos, S.; Burnett, R.A. Pacific Northwest Lab., Richland, WA (United States). May 1995. 25p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9505242–1: 1995 ESRI user conference, Palm Springs, CA (United States), 22-26 May 1995). Order Number DE95014613. Source: OSTI; NTIS; GPO Dep.

The Federal Emergency Management Information System (FEMIS) is a decision support system that integrates all phases of emergency management. FEMIS is designed to support the emergency manager in planning, coordination, response, training and exercise. FEMIS uses a classic client-server architecture. The FEMIS component modules include a Human-Computer Interface (HCI), a relational database management system (RDBMS), an electronic mail system, a report generator, a project management system, a geographic information system (GIS), and hazard specific modeling and analysis tools. Of these systems, the RDBMS and the evacuation model reside on a UNIX platform while all the other software reside on networked personal computer (PC) workstations. ArcView 2.0 is the GIS product used to support FEMIS at each PC workstation. ARC/INFO is loaded on the UNIX-based server and is used to prepare the spatial data. This paper describes the way GIS support for FEMIS was built using Avenue scripts and the inter-process communications available through ArcView 2.0. It also identifies the limitations encountered and the way the HCI was built to overcome them. The final product is a fully integrated responsive, user-oriented decision support system, capable of linking the planning, response, recovery, and mitigation phases of emergency management.

25008 (SAND–94-3124) **Assembly sequencing with toleranced parts.** Latombe, J.C. (Stanford Univ., CA (United States). Robotics Lab.); Wilson, R.H. Sandia National Labs., Albuquerque, NM (United States). 21 Feb 1995. 30p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Department of Defense, Washington, DC (United States);Stanford Integrated Mfg. Association (United States). DOE Contract AC04-94AL85000. Order Number DE95011832. Source: OSTI; NTIS; GPO Dep.

The goal of assembly sequencing is to plan a feasible series of operations to construct a product from its individual parts. Previous research has thoroughly investigated assembly sequencing under the assumption that parts have nominal geometry. This paper considers the case where parts have toleranced geometry. Its main contribution is an efficient procedure that decides if a product admits an assembly sequence with infinite translations that is feasible for all possible instances of the components within the specified tolerances. If the product admits one such sequence, the procedure can also generate it. For the cases where there exists no such assembly sequence, another procedure is proposed which generates assembly sequences that are feasible only for some values of the toleranced dimensions. If this procedure produces no such sequence, then no instance of the product is assemblable. Finally, this paper analyzes the relation between assembly and disassembly sequences in the presence of toleranced parts. This work assumes a simple, but non-trivial tolerance language that falls short of capturing all imperfections of a manufacturing process. Hence, it is only one step toward assembly sequencing with toleranced parts.

25009 (SLAC-R–95-464) **Proceedings of the REXX symposium for developers and users.** Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1995. 373p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-9505198–: REXX symposium for developers and users, Stanford, CA (United States), 1-3 May 1995). Order Number DE95016261. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains viewgraphs on the following topics: REXX 1995 – the growth of a language; the future of REXX; problems and issues writing REXX compliers; writing CGI scripts for WWW using REXX; object REXX: up close and personal; object REXX: openDoc support; report from the X3J18 committee; Centerpiece and object oriented REXX; REXX, distributed systems and objects; getting ready for object REXX; SOM – present and future; rexinda; REXX for CICS/ESA; REXX changes in OS/2 warp; S/REXX by Benaroya; a REXX-based stock exchange real-time client/server environment for research, educational and public relations purposes: implementation and usage issues; REXX/370 Compiler and Library 1995; and how REXX helped me hit the ground running in UNIX.

25010 (SREL–50) **UnCensor© v4.0.** Newman, M.C.; Greene, K.D.; Dixon, P.M. Savannah River Ecology Lab., Aiken, SC (United States). 1995. 92p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract AC09-76SR00819. Order Number DE95015347. Source: OSTI; NTIS; GPO Dep.

UnCensor© is a program that estimates the mean, standard deviation, variance, and the confidence interval on the mean of left censored data sets. At present, the program can provide estimates for normal and two-parameter lognormal data sets. Large ($N > 20$) and small ($N \leq 20$) data sets can be handled. UnCensor© provides estimates by the application of several statistical methods. At present, these methods include the following. The explanations are taken from the appendix of the companion paper for this program (Newman et al. 1989 and Newman 1995.)

25011 (UCRL-CR–120462) **Involving users in the design cycle for parallel tools second period September 1, 1994–January 31, 1995.** Pancake, C.M. (Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science). Lawrence Livermore National Lab., CA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Computer Science. 31 Jan 1995. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95013275. Source: OSTI; NTIS; GPO Dep.

Parallel programmers do not use software tools, in spite fact that parallel development is a difficult and time-consuming task that could benefit from tool support. It has become increasingly clear that the simple availability of elegant, powerful software tools employing the latest technology is not enough. Usability is the real key to success; users simply do not adopt tools that fail to respond to their needs. Research in the area of usability engineering indicates that five design principles can have significant impact on parallel tool usability: tools must be based on demonstrable user requirements; actively involve users throughout tool design; minimize tool complexity to reduce the learning curve support the tool across multiple machine platforms to amortize the user's investment employ iterative refinement techniques to improve tool usability. Those principles served as the starting point for a Parallel Tools Consortium project to develop a tool that will help users determine the final state of a program that crashes or is terminated forcibly. Carried out over a period of ten months, the project involved the collaboration of tool researchers, and implementors, and users. This report describes how user-centered design techniques were applied to ensure that the tool would provide simple, intuitive support for the programmer's task. Users were recruited for the project working group so that they could have direct input to design decisions, even in the earliest sets of user trials. Additional feedback was acquired from a broader user base, in three distinct phases. These were spaced out over a period of six months so that feedback could be analyzed, then applied to refine the tool before the next trial. In some cases, user input kept us from investing substantial effort in features that would not have been used or appreciated. In others, feedback showed us where our conceptions of usefulness did not quite align with those of the user community.

25012 (UCRL-ID–119734) **LLNL state-of-the-art codes for source calculations.** Glenn, L.A. Lawrence Livermore National Lab., CA (United States). Feb 1995. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014673. Source: OSTI; NTIS; GPO Dep.

The explosion-source region is defined as the region surrounding an underground explosion that cannot be described by elastic or anelastic theory. This region extends typically to ranges on the order of 1 km/kt. For the simulation or analysis of seismic signals, what is required is the time resolved motion and stress state at the inelastic boundary. Various analytic approximations have been made for these boundary conditions, but since they rely on near-field empirical data they cannot be expected to reliably extrapolate to different explosion sites. More important, without some knowledge of the initial energy density and the characteristics of the medium immediately surrounding the explosion, these simplified models are unable to distinguish chemical from nuclear explosions, identify cavity decoupling, or account for such phenomena as anomalous dissipation via pore collapse. The purpose here is to document the state-of-the-art codes at LLNL involved in simulating underground (chemical and nuclear) explosions and, in so doing, present an overview of the physics. In what follows, the authors first describe the fundamental equations involved, discuss solution methods, coordinate frames and dimensionality. Then they identify the codes used at LLNL and their limitations. A companion report will describe the factors that most influence the seismic response, i.e., the source properties important for discrimination. That report will emphasize the coupling between the rock properties and the characteristics of the explosion cavity.

25013 (UCRL-ID–120484) **Smile (System/Machine-Independent Local Environment).** Fletcher, J.G. Lawrence Livermore National Lab., CA (United States). Apr 1988. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015129. Source: OSTI; NTIS; GPO Dep.

This document defines the characteristics of Smile, a System/machine-independent local environment. This environment consists primarily of a number of primitives (types, macros, procedure calls, and variables) that a program may use; these primitives provide facilities, such as memory allocation, timing, tasking and synchronization beyond those typically provided by a programming language. The intent is that a program will be portable from system to system and from machine to machine if it relies only on the portable aspects of its programming language and on the Smile primitives. For this to be so, Smile itself must be implemented on each system and machine, most likely using non-portable constructions; that is, while the environment provided by Smile is intended to be portable, the implementation of Smile is not necessarily so. In order to make the implementation of Smile as easy as possible and thereby expedite the porting of programs to a new system or a new machine, Smile has been defined to provide a minimal portable environment; that is, simple primitives are defined, out of which more complex facilities may be constructed using portable procedures. The implementation of Smile can be as any of the following: the underlying software environment for the operating system of an otherwise "bare" machine, a "guest" system environment built upon a preexisting operating system, an environment within a "user" process run by an operating system, or a single environment for an entire machine, encompassing both system and "user" processes. In the first three of these cases the tasks provided by Smile are "lightweight processes" multiplexed within preexisting processes or the system, while in the last case they also include the system processes themselves.

25014 (UCRL-ID–120485) **APST Interfaces in LINCS.** Fletcher, J.G. Lawrence Livermore National Lab., CA (United States). Jul 1995. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95015105. Source: OSTI; NTIS; GPO Dep.

APST is an acronym for the four highest of the seven layers of the LINCS hierarchy of communication protocols: (from high to low) Application, Presentation, Session, and Transport. Routines in each but the lowest of these APST layers can utilize the facilities of any lower APST layer (normally, but not necessarily, the immediately next lower layer) by invoking various primitives (macros that in most cases are subroutine calls) defining the upper interface of the lower layer. So there are three APST interfaces: Presentation layer, used by the Application layer; Session layer, normally used by the Presentation layer; and Transport layer, normally used by the Session layer. Logically, each end of a stream (unidirectional sequence of transmitted information) is handled by three modules, one module each for the Presentation, Session, and Transport layers, and each of these modules deals with only that one end of that one stream. The internal workings of the layers, particularly the Transport layer, do not necessarily exhibit this same modularization; for example, the two oppositely directed streams between the same two ends (constituting an association) may interact within a layer. However, such interaction is an implementational detail of no direct interest to those utilizing the layer. The present document does not describe implementation, nor does it discuss in any detail how the modules employ packet headings and data formats to communicate with their partner modules at the other end of a stream. There being one logical module per end of stream is a characteristic only of the Presentation, Session, and Transport layers. An Application layer module usually manages several streams, orchestrating them to achieve some desired purpose. The modules of the layers (Network, Link, and Physical) below the APST layers

each handle many streams, multiplexing them through the nodes and channels of the network to transmit them from their origins to their destinations.

25015 (UCRL-JC–119772) **The parallel I/O architecture of the High Performance Storage System (HPSS).** Watson, R.W. (Lawrence Livermore National Lab., CA (United States)); Coyne, R.A. Lawrence Livermore National Lab., CA (United States). Feb 1995. 40p. Sponsored by USDOE, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-950985–1: 14. Institute of Electrical and Electronics Engineers (IEEE) symposium on mass storage systems, Monterey, CA (United States), 11-14 Sep 1995). Order Number DE95007126. Source: OSTI; NTIS; GPO Dep.

Rapid improvements in computational science, processing capability, main memory sizes, data collection devices, multimedia capabilities and integration of enterprise data are producing very large datasets (10s-100s of gigabytes to terabytes). This rapid growth of data has resulted in a serious imbalance in I/O and storage system performance and functionality. One promising approach to restoring balanced I/O and storage system performance is use of parallel data transfer techniques for client access to storage, device-to-device transfers, and remote file transfers. This paper describes the parallel I/O architecture and mechanisms, Parallel Transport Protocol, parallel FIP, and parallel client Application Programming Interface (API) used by the High Performance Storage System (HPSS). Parallel storage integration issues with a local parallel file system are also discussed.

25016 (UCRL-JC–120527) **Visualization of transient finite element analyses on large unstructured grids.** Dovey, D. Lawrence Livermore National Lab., CA (United States). 22 Mar 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9510141–1: Institute for Electrical and Electronics Engineers visualization '95, Atlanta, GA (United States), 30 Oct - 3 nov 1995). Order Number DE95011529. Source: OSTI; NTIS; GPO Dep.

Three-dimensional transient finite element analysis is performed on unstructured grids. A trend toward running larger analysis problems, combined with a desire for interactive animation of analysis results, demands efficient visualization techniques. This paper discusses a set of data structures and algorithms for visualizing transient analysis results on unstructured grids and introduces some modifications in order to better support large grids. In particular, an element grouping approach is used to reduce the amount of memory needed for external surface determination and to speed up "point in element" tests. The techniques described lend themselves to visualization of analyses carried out in parallel on a massively parallel computer (MPC).

25017 (UCRL-JC–120528) **Vector carpets.** Dovey, D. Lawrence Livermore National Lab., CA (United States). 22 Mar 1995. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9510141–2: Institute for Electrical and Electronics Engineers visualization '95, Atlanta, GA (United States), 30 Oct - 3 nov 1995). Order Number DE95011530. Source: OSTI; NTIS; GPO Dep.

Previous papers have described a general method for visualizing vector fields that involves drawing many small "glyphs" to represent the field. This paper shows how to improve the speed of the algorithm by utilizing hardware support for line drawing and extends the technique from regular to unstructured grids. The new approach can be used to visualize vector fields at arbitrary surfaces within regular and unstructured grids. Applications of the algorithm include interactive visualization of transient electromagnetic fields and visualization of velocity fields in fluid flow problems.

25018 (UCRL-LR–119748) **Large-eddy simulation of the Rayleigh-Taylor instability on a massively parallel computer.** Amala, P.A.K. (California Univ., Davis, CA (United States). Dept. of Applied Science). Lawrence Livermore National Lab., CA (United States); California Univ., Davis, CA (United States). Dept. of Applied Science. Mar 1995. 135p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE95014132. Source: OSTI; NTIS; GPO Dep.

A computational model for the solution of the three-dimensional Navier-Stokes equations is developed. This model includes a turbulence model: a modified Smagorinsky eddy-viscosity with a stochastic backscatter extension. The resultant equations are solved using finite difference techniques: the second-order explicit Lax-Wendroff schemes. This computational model is implemented on a massively parallel computer. Programming models on massively parallel computers are next studied. It is desired to determine the best programming model for the developed computational model. To this end, three different codes are tested on a current massively parallel computer: the CM-5 at Los Alamos. Each code uses a different programming model: one is a data parallel code; the other two are message passing codes. Timing studies are done to determine which method is the fastest. The data parallel approach turns out to be the fastest method on the CM-5 by at least an order of magnitude. The resultant code is then used to study a current problem of interest to the computational fluid dynamics community. This is the Rayleigh-Taylor instability. The Lax-Wendroff methods handle shocks and sharp interfaces poorly. To this end, the Rayleigh-Taylor linear analysis is modified to include a smoothed interface. The linear growth rate problem is then investigated. Finally, the problem of the randomly perturbed interface is examined. Stochastic backscatter breaks the symmetry of the stationary unstable interface and generates a mixing layer growing at the experimentally observed rate. 115 refs., 51 figs., 19 tabs.

25019 (WHC-SD-GN-UM–30005-Rev.1) **AutoCAD discipline layering convention. Revision 1.** Nielsen, B.L. Westinghouse Hanford Co., Richland, WA (United States). 17 May 1995. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE95013348. Source: OSTI; NTIS; GPO Dep.

This document is a user's guide to establishing layering standards for drawing development. Uniform layering standards are established to exchange of AutoCAD datasets between organizations and companies. Consistency in the layering conventions assists the user through logical separation and identification of drawing data. This allows the user to view and plot related aspects of a drawing separately or in combination. The use of color and Linetype by layer is the preferred layering convention method, however to accommodate specific needs, colors and linetypes can also be assigned on an entity basis. New drawing setup files (also identified in AutoCAD documentation as Prototype drawings) use this layering convention to establish discipline drawing layers that are routinely used. Additions, deletions or revisions to the layering conventions are encourage.

9903 Information Handling

Refer also to citation(s) 23186, 23209, 23351, 23368, 23402, 23472, 23575, 23619, 23726, 23769, 24551, 24816, 24949, 25006, 25007

25020 (ANL/DIS/CP–86615) **Buffer reduction in an attribute-based concurrent transaction processing system.** Henschen, L.J. (Northwestern Univ., Evanston, IL (United States). Dept. of Electrical Engineering and Computer Science); Lee, J.C. Argonne National Lab., IL (United States). [1995]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9507135–1: 7. international conference on computing and information, Ontario (Canada), 5-8 Jul 1995). Order Number DE95014224. Source: OSTI; NTIS; GPO Dep.

The authors presented a way to improve the buffer usage for the transaction management model in an earlier study. The method presented in this paper identifies the conflicting and the non-conflicting parts of the affected data sets and separates them. The original operations are converted into two sets of operations–one set operates on disjoint data and can be executed in parallel, another set operates on conflicting data using buffers. This approach will reduce the size of the buffers used in the earlier approach.

25021 (ANL/OTD-PR/CP–86451) **Chemical management system at Argonne National Laboratory.** Morss, H.S. (Argonne

National Lab., IL (United States)); Hischier, R.C.; Keto, D.N.; Woodring, J.L.; Davis, J.T.; Sherva, B. Argonne National Lab., IL (United States). [1995]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-9505234–1: 2. international symposium on computerized chemical data standards: databases, data interchange, and information systems, Columbus, OH (United States), 10-12 May 1995). Order Number DE95013695. Source: OSTI; NTIS; GPO Dep.

The Argonne Chemical Management System (CMS) is comprised of several applications and the Infrastructure Modules. The Infrastructure Modules, which provide the integrated computing software foundation, include a security processor, common tables, reporting framework, utilities, and other facilities common to applications processing chemical information. The MSDS Sheets were scanned and the images stored for automated faxing to the requester. User searches are accomplished based on "search" data keyed into the Oracle Tables; the desired MSDS is subsequently faxed. The system has been designed as an "open" system and is totally portable. During development and production the CMS has operated in VAX, VMS, Sun Unix, and Hewlett-Packard HP-UX environments. The only restrictions are that the MSDS Faxing Server must operate under Unix and the bar code scanning processes are accomplished using a portable PC. The current system consists of 20 Oracle Tables, over 350 columns of data, 25 Standard reports, 45 screens, and a number of utilities. With the Oracle RDBMS the computing platform may be sized to the volume of data and processing activity. The Laboratory's implementation is on an HP 9000 Model H50 with 256 megabytes of memory, 32 concurrent users, and 8 gigabytes of disk storage that is primarily for the MSDS images.

25022 (BNWL-D–260) **Letter to D. R. Harbur.** King, R.R. Battelle-Northwest, Richland, WA (United States). Pacific Northwest Lab. 18 Nov 1976. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE95012661. Source: OSTI; NTIS; GPO Dep.

Short communication. HANFORD RESERVATION/classified information; SECURITY; ADMINISTRATIVE PROCEDURES

25023 (CRIE-R–93016) **CRIEPI-FPA, a software sizing technique.** Takahashi, M. (Central Research Institute of Electric Power Industry, Tokyo (Japan)); Hishitani, J. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Mar 1994. 28p. (In Japanese). Order Number DE95790578. Source: OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan.

A technique was developed in which the function point (FP) of software was calculated from required specifications and a sizing estimation was performed for the development of business application software. The functions of this technique were classified into 8 kinds consisting of a menu screen, input file, input screen, input/output file, input/output screen, output file, output screen and business form. Discrimination on the degree of difficulty was made on a subjective three phase evaluation from two viewpoints, the 'number of items' and the 'complexity of processing'. The estimation procedure was such that, first, the number of kinds was counted for functional parts along the classification, a weighted summary was made with the FP reference value, and the FP was calculated. The result was then substituted in the estimation formula for the sizing estimation and, the sizing for the development was obtained. The FP reference value and the coefficient of the estimation formula were decided based on the actual development data in the past. This technique was experimentally applied to the software development projects of 40 software developers. As a result, the estimation of source lines was in the range of less than $\pm 30\%$ of the actual value on 60% or more projects. 22 refs., 8 figs., 4 tabs.

25024 (DOE/EIA–0569(95/1Q)) **EIA directory of electronic products, first quarter 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of the National Energy Information System. Jun 1995. 77p. Sponsored by USDOE, Washington, DC (United States). Order Number DE95014357. Source: OSTI; NTIS; GPO Dep.

The Energy Information Administration (EIA) makes available for public use a series of machine-readable data files and computer models. The data files and models are made available to the public on magnetic tapes. In addition, selected data files/models are available on diskette for IBM-compatible personal computers. EIA, as the independent statistical and analytical branch of the Department of Energy, provides assistance to the general public through the National Energy Information Center (NEIC). For each product listed in this directory, a detailed abstract is provided which describes the data published. Specific technical questions may be referred to the appropriate contact person.

25025 (JINR-D–13-92-581, pp. 6-21) **Present-day state of automatization of scientific researches in academic institutes.** Gulyaev, Yu.V.; Zhuravlev, E.E.; Olejnikov, A.Ya. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

The state of works on technology relative to creation and development of technical and programming means for scientific research computerized systems based on international standards, networks and interfaces is presented. The review is based on the analysis of periodical publications, conference and symposia materials, as well as materials specially presented to the Council on automation. An attempt is made to forecast the basic trends. 16 refs.; 19 figs.

25026 (JINR-D–13-92-581, pp. 22-31) **Open buses in physical research.** Kolpakov, I.F. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

New generation of open buses VME64, VSB, Futurebus, SCI and FDDI, which make it possible to process large-volume data flows by experiments on supercolliders, is described. The data on the throughput capacity of these standard buses. High-efficiency systems for data acquisition and processing may be created through their application. Problems on search of new architectural decisions using the VME64, VXI, Futurebus and SCI standards may be considered. 10 refs.; 2 figs.

25027 (JINR-D–13-92-581, pp. 32-43) **Radial and ring two-point structures for data collection and processing.** Vinogradov, V.I. (RAN, Inst. Yadernykh Issledovanij, Moscow (Russian Federation)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

Comparative analysis of two-point communication structures of radial and ring topology is carried out. Development of ring structures with application of various transmission types (parallel, consecutive) and common communication medium is shown. Versions of perspective ring structures for subsystems of operational memory and distributive input-output are considered. The two-point communication structures may be applied for construction of various communication modular systems, accomplished in the CAMAC and VME standards. 12 refs.

25028 (JINR-D–13-92-581, pp. 136-142) **Autonomous system for digital signal processing.** Ganbat, G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Glejbman, Eh.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 290p. (In Russian). (CONF-9209499–: 15. international symposium on nuclear electronics, Warsaw (Poland), 29 Sep - 2 oct 1992). In *15. International symposium on nuclear electronics and International seminar CAMAC-92.* Order Number DE95633648. Source: OSTI; NTIS (US Sales Only); INIS.

Autonomous system for digital signal processing is developed. The system is applied for measuring parameters of the betatron beam oscillations at the U-70 accelerator (IFVE, Protvino). The system is based on the kreit microcomputer and two units of fast processor accomplished on the basis of the TMS 32010 type DSP.

The fast processor unit operates as the SLAVE in the microprocessor system MIK, wherein the CAMAC/MULTIBUS combined protocol is realized with the purpose of organizing multiprocessor operation. 5 refs.; 3 figs.

25029 (PNL-SA–23964) **Quest for quality informal proceedings of the first Hanford Site Technical Communications Seminar.** Allen, R.E. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9311311–Summ.: Quest for quality communications seminar, Richland, WA (United States), 17 Nov 1993). Order Number DE95011497. Source: OSTI; NTIS; GPO Dep.

Eighty-eight people from five Hanford contractors gathered November 17, 1993, at Pacific Northwest Laboratory (PNL) to embark on a quest for quality in Technical Communications. PNL's Applied Technologies Communication (ATC) section of the Technical Information and Communications Department (TI&CD) hosted the half-day Quest for Quality seminar, which covered such topics as document design, site-wide production standards, and "reinventing government." The seminar was the first of its kind to include technical communications professionals from all Hanford Site contractors; attendees included technical editors and writers, publications assistants, text processors, and document production staff. A complete list of the attendees is included as Appendix A and the presenters are listed in Appendix B. Five Hanford contractors have technical communications staffs, all trying to meet the needs of one primary customer: the US Department of Energy (DOE). Historically, these contractors have maintained different processes and standards with regard to document production, and little interaction or information sharing has occurred. To begin remedying that situation, PNL invited technical communicators across the Hanford Site to attend the first Quest for Quality Technical Communications Seminar. The purpose of the seminar was to identify ways to improve the quality of Hanford's communication products and processes and to strengthen ties among technical communications staffs at the site. We hoped to open the lines of communication for future collaborative efforts.

25030 (SAND–95-0226C) **User-driven product data manager system design.** Sandia National Labs., Albuquerque, NM (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-951092–2: Human Factors and Ergonomics Society meeting, San Diego, CA (United States), 9-13 Oct 1995). Order Number DE95007739. Source: OSTI; NTIS; GPO Dep.

With the infusion of information technologies into product development and production processes, effective management of product data is becoming essential to modern production enterprises. When an enterprise-wide Product Data Manager (PDM) is implemented, PDM designers must satisfy the requirements of individual users with different job functions and requirements, as well as the requirements of the enterprise as a whole. Concern must also be shown for the interrelationships between information, methods for retrieving archival information and integration of the PDM into the product development process. This paper describes a user-driven approach applied to PDM design for an agile manufacturing pilot project at Sandia National Laboratories that has been successful in achieving a much faster design-to-production process for a precision electro mechanical surety device.

25031 (SAND–95-0336C) **On-line controlled documents: Lessons learned.** Cochrell, R.C.; Steele, C.M. Sandia National Labs., Albuquerque, NM (United States). [1995]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-950876–1: 19. annual symposium of the Nuclear Information Records Management Association, Washington, DC (United States), 27-30 Aug 1995). Order Number DE95013555. Source: OSTI; NTIS; GPO Dep.

Placing Controlled Documents on-line on a computer network seems like the solution to many problems, one being distribution, with a path toward a paperless office. However, many problems presented themselves as we were designing the system and placing the documents on-line. Although we planned and established a Process Management Team to help work out the bugs, we still encountered many obstacles in the process. This presentation will cover the "trials and tribulations" of placing Controlled Documents on a computer network at three different sites. We will discuss the process we went through, the problems we encountered, the software we used, and how we got management to buy into the process.

25032 (SAND–95-1065) **Sandia National Laboratories (SNL) and Oak Ridge National Laboratories (ORNL) joint development of SNL's sample tracking, analysis and reporting (STAR) information system.** Fish, J. (and others); Campbell, D.; Jenkins, B. Sandia National Labs., Albuquerque, NM (United States). May 1995. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE95014492. Source: OSTI; NTIS; GPO Dep.

A comprehensive environmental sample management program allocates much of its resources to collecting, managing, and manipulating information. A computerized system that collects information at the field sampling point, tracks the sample to analytical labs and loads electronic data deliverables from these labs, while maintaining chain of custody and data integrity, is efficient and cost effective for providing consistent and accurate, legally defensible sample data. In June 1993, a team was formed to gather Sample Management Office requirements and begin development of a sample tracking system. This paper is an overview of experiences encountered when Sandia transferred and implemented sample software from the Waste Area Group (WAG6) at ORNL.

25033 (SAND–95-1168C) **A systems configuration toolkit for modular integration of mechatronic resources.** Oppel, F.J. III; Palmquist, R. Sandia National Labs., Albuquerque, NM (United States). [1995]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9506178–3: International Association of Science and Technology for Development conference on robotics and manufacturing, Cancun (Mexico), 14-17 Jun 1995). Order Number DE95013863. Source: OSTI; NTIS; GPO Dep.

The use of the NII (National Information Infrastructure) is growing rapidly in the number of users and in the areas in which it is being applied. Sandia is using, the NII to leverage the use of geographically distributed mechatronic (electromechanical) assets. This paper discusses the availability of networks, new challenges for robotics technology, and how the use of networks is helping to meet these challenges. A brief overview of the NII is provided, followed by a listing of "needs" within the intelligent systems community. An approach is then given for meeting, these needs and, finally, implementation, examples, and future research directions are discussed.

Corporate Author Index

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AC02-76CH03000	**Fermi National Accelerator Lab., Batavia, IL (United States)**	
	20:24111	FNAL/C–95/171
	20:24185	FNAL/C–95/118
	20:24186	FNAL/C–95/143
	20:24187	FNAL/C–95/170
	20:24188	FNAL-TM–1937
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	20:24780	FNAL/C–95/117
	20:24783	FNAL/C–95/115-E
	20:24788	FNAL/C–95/046-E
	20:24789	FNAL/C–95/096-E
	20:24790	FNAL/C–95/103-E
	20:24791	FNAL/C–95/109-E
	20:24792	FNAL/C–95/144
	20:24793	FNAL/C–95/150-E
	20:24794	FNAL/C–95/161-E
	20:24986	FNAL–TM-1934
AC02-76CH03073	**Princeton Univ., NJ (United States)**	
	20:24905	PATENTS-US–A8067967
	Princeton Univ., NJ (United States). Plasma Physics Lab.	
	20:24874	PPPL–3011-R
	20:24875	PPPL–3114
	20:24876	PPPL–3116
	20:24877	PPPL–3120
AC02-85CE26515	**Joseph Technology Corp., Inc., Woodcliff Lake, NJ (United States)**	
	20:23803	DOE/CE/26515–T1
AC02-92CE40960	**Argonne National Lab., IL (United States)**	
	20:23880	ANL/ET/CP–85328
AC02-94CE50389	**Ford Motor Co., Dearborn, MI (United States)**	
	20:23813	DOE/CE/50389–1
AC03-76SF00098	**California Univ., Berkeley, CA (United States). Lawrence Berkeley Lab.**	
	20:23065	DOE/BC–95000153

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	20:23906	CONF-950412--16
	Stanford Linear Accelerator Center, Menlo Park, CA (United States)	
	20:24335	SLAC-PUB--95-6812
	20:24336	SLAC-PUB--95-6897
	Lawrence Berkeley Lab., CA (United States)	
	20:23063	DOE/BC--95000151
	20:23064	DOE/BC--95000152
	20:23088	DOE/BC--95000168
	20:23089	DOE/BC--95000169
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	20:23213	LBL--37332
	20:23214	LBL--37337
	20:23445	LBL--37222
	20:23962	LBL--36465
	20:23963	LBL--37170
	20:23987	LBL-PUB--754
	20:24090	LBL--36565
	20:24237	LBL--36459
	20:24242	LBL-PUB--754
	20:24328	LBL--35890
	20:24594	LBL--36400
	20:24756	LBL--36537
	20:24760	LBL-PUB--754
	20:24767	LBL-PUB--754
	20:24800	LBL--36499
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	20:24825	LBL--36370
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	20:24848	LBL-PUB--754
	20:24903	LBL--36487
	20:24939	LBL-PUB--5409
	20:24999	LBL--37206
	Lawrence Livermore National Lab., CA (United States)	
	20:23897	UCRL-JC--120259
	20:23919	LBL--37379
	20:24341	UCRL-JC--120158
AC03-76SF00515	**Stanford Linear Accelerator Center, Menlo Park, CA (United States)**	
	20:24092	SLAC-PUB--95-6825
	20:24143	SLAC-PUB--95-6684
	20:24144	SLAC-PUB--95-6791
	20:24145	SLAC-PUB--95-6802
	20:24146	SLAC-PUB--95-6806
	20:24147	SLAC-PUB--95-6840
	20:24280	SLAC-PUB--95-6879
	20:24281	SLAC-PUB--95-6894
	20:24282	SLAC-PUB--95-6906
	20:24283	SLAC-PUB--95-6907
	20:24284	SLAC-PUB--95-6908
	20:24335	SLAC-PUB--95-6812
	20:24336	SLAC-PUB--95-6897
	20:24337	SLAC-PUB--95-6901
	20:24338	SLAC-PUB--95-6902
	20:25009	SLAC-R--95-464
	Lawrence Livermore National Lab., CA (United States)	
	20:24339	UCRL-JC--119407
	20:24341	UCRL-JC--120158
AC03-89ER51114	**Oak Ridge National Lab., TN (United States)**	
	20:24859	CONF-9505105--6
	General Atomics, San Diego, CA (United States)	
	20:24864	GA-A--22048
	20:24865	GA-A--22062
AC03-91SF18852	**Martin Marietta Astro Space, King of Prussia, PA (United States)**	
	20:23558	DOE/SF/18852--T53
AC03-94SF20218	**AECL Technologies, Inc., Rockville, MD (United States)**	
	20:23132	DOE/SF/20218--T2
AC04-76DP00613	**Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div.**	
	20:23794	KCP--613-5587
	20:23986	KCP--613-5570
	20:24429	KCP--613-5430
	20:24430	KCP--613-5536
AC04-76DP03533	**Rockwell International Corp., Golden, CO (United States)**	
	20:24604	PATENTS-US--A8062512
AC04-76EV01013	**Inhalation Toxicology Research Inst., Albuquerque, NM (United States)**	
	20:24588	ITRI--145
AC04-86AL31950	**USDOE Albuquerque Operations Office, Carlsbad, NM (United States). Waste Isolation Pilot Plant Project Office**	
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	USDOE Carlsbad Area Office, NM (United States)	
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AC04-87ID12624	**Dow Corning Corp., Midland, MI (United States)**	
	20:23785	DOE/ID/12624--3
AC04-91AL62350	**Jacobs Engineering Group, Inc., Albuquerque, NM (United States)**	
	20:23317	DOE/AL/62350--171
	20:23318	DOE/AL/62350--191
	20:23340	DOE/AL/62350--157-Rev.
	20:23341	DOE/AL/62350--179
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	20:24568	DOE/AL/62350--187
AC04-91AL65030	**Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (United States)**	
	20:24413	DOE/AL/65030--9421
	20:24414	DOE/AL/65030--9505
AC04-92AL73000	**Lockheed Martin Specialty Components, Inc., Largo, FL (United States)**	
	20:23361	MMSC-EM--95011
AC04-93AL96904	**USDOE Carlsbad Area Office, NM (United States)**	
	20:23180	DOE/CAO--2056-Vol.3-Draft
AC04-94AL85000	**Sandia National Labs., Albuquerque, NM (United States)**	
	20:23000	SAND--95-1124C
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	20:23045	SAND--95-8251
	20:23046	SAND--95-8252
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	20:23241	SAND–95-1236
	20:23242	SAND–95-8615C
	20:23332	SAND–94-2585
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	20:23370	SAND–95-1304
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	20:23397	SAND–95-1253C
	20:23398	SAND–95-1273C
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	20:23669	SAND–95-1313C
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	20:23685	SAND–95-1251C
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	20:25033	SAND–95-1168C
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	20:23871	SAND–95-8534C
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	20:23973	SAND–95-8497C
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	20:24047	SAND–95-8550C
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	20:24418	SAND–95-8235
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AC05-76OR00001	**Oak Ridge National Lab., TN (United States)**	
	20:23130	POEF-SH–31
AC05-76OR00033	**Oak Ridge Associated Universities, Inc., TN (United States)**	
	20:24931	CONF-9410190–Absts.
	Oak Ridge National Lab., TN (United States)	
	20:23906	CONF-950412–16
	Oak Ridge Inst. for Science and Education, TN (United States)	
	20:23362	ORISE–93/J-42
	20:23682	DOE/OR/00033–T655
	20:24700	DOE/OR/00033–T641
	20:24701	DOE/OR/00033–T656
	20:24724	ORISE–94/G-34
	Oak Ridge Inst. for Science and Education, TN (United States). Medical Sciences Div.	
	20:24725	ORISE–95/B-22
AC05-84OR21400	**Oak Ridge National Lab., TN (United States)**	
	20:22983	CONF-950801–4
	20:23150	ORNL/TM–13012
	20:23174	CONF-9505101–5
	20:23175	CONF-9505101–6
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	20:23223	ORNL/TM–13034

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	20:23356	ES/ER/TM–106
	20:23363	ORNL/RASA–94/3
	20:23364	ORNL/RASA–95/3
	20:23386	ORNL/MD/LTR–13
	20:23387	ORNL/TM–12979
	20:23408	ORNL/M–3774
	20:23410	ORNL/ER–230
	20:23430	CONF-9410357–1
	20:23431	ORNL–6858
	20:23496	ORNL/TM–12863
	20:23498	CONF-950388–2
	20:23514	CONF-950564–9
	20:23574	CONF-9507130–1
	20:23593	CONF-950740–49
	20:23594	CONF-9509100–2
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	20:23605	ORNL/M–3738
	20:23606	ORNL/M–3993
	20:23614	CONF-950564–1
	20:23657	ORNL–6804/R1
	20:23676	CONF-9506115–2
	20:23677	CONF-9506115–6
	20:23689	CONF-9506115–8
	20:23690	CONF-9506115–9
	20:23702	ORNL/TM–13031
	20:23714	ORNL/TM–12902
	20:23728	CONF-9506115–7
	20:23759	ORNL/CON–412
	20:23760	ORNL/SUB–91-SH225
	20:23764	CONF-950193–2
	20:23765	CONF-9504177–1
	20:23775	CONF-9504123–1
	20:23795	ORNL/TM–12905
	20:23817	CONF-9410309–5
	20:23819	CONF-9504160–5
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	20:23842	CONF-950412–23
	20:23843	CONF-9504176–1
	20:23844	CONF-9505204–5
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	20:23847	CONF-950740–66
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	20:23883	CONF-941144–155
	20:23884	CONF-941144–164
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	20:23905	CONF-9503144–2
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	20:23907	CONF-950412–21
	20:23941	CONF-9505101–1
	20:23942	CONF-950853–3
	20:23977	CONF-9506200–1
	20:23978	CONF-9506200–2
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	20:23992	ORNL/TM–12374
	20:23993	ORNL/TM–12732
	20:23994	ORNL/TM–12813-Pt.2
	20:24026	CONF-9505100–1
	20:24030	CONF-9504161–2
	20:24033	CONF-951073–5
	20:24347	CONF-950209–10
	20:24348	CONF-951073–2
	20:24349	CONF-951073–4
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	20:24385	ORNL/TM–12978
	20:24407	CONF-950232–36
	20:24408	CONF-9503164–3
	20:24409	CONF-9503168–1
	20:24528	CONF-950226–46
	20:24529	CONF-9506191–2
	20:24546	ORNL/TM–12861
	20:24564	CONF-950209–8
	20:24565	CONF-950450–10
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	20:24596	ORNL/RASA–95/4
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	20:24598	ORNL/RASA–95/6
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	20:24977	CONF-9410337–1
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	20:25001	ORNL/TM–12988
AC05-84OS21400	**Oak Ridge Y-12 Plant, TN (United States)**	
	20:23801	Y/ME–94-08
AC05-84OT21400	**Oak Ridge Y-12 Plant, TN (United States)**	
	20:24591	K/NSP–275
	Oak Ridge K-25 Site, TN (United States)	
	20:24590	K/NSP–274
AC05-86OR21548	**MK-Ferguson Co., St. Charles, MO (United States)**	
	20:23352	DOE/OR/21548–436-Rev.
AC05-91OR21999	**Hayes, Seay, Mattern and Mattern, Roanoke, VA (United States)**	
	20:23655	DOE/OR/21999–T2
AC05-93OR22028	**Jacobs Engineering Group, Inc., Oak Ridge, TN (United States)**	
	20:24580	DOE/OR/22028–T19
AC06-76RL01830	**Argonne National Lab., IL (United States)**	
	20:23161	ANL/CMT/CP–84526
	Battelle-Northwest, Richland, WA (United States). Pacific Northwest Lab.	
	20:25022	BNWL-D–260
	USDOE, Washington, DC (United States)	
	20:24887	DOE-STD–0028-95
	Lawrence Livermore National Lab., CA (United States)	
	20:23897	UCRL-JC–120259
	General Atomics, San Diego, CA (United States)	
	20:24864	GA-A–22048
	Lockheed Martin Energy Systems, Inc., Oak Ridge, TN (United States)	
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	Hanford Works, Richland, WA (United States)	
	20:23133	HW–19758
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	General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation	
	20:23138	HW–59743
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	Sandia National Labs., Albuquerque, NM (United States)	
	20:23928	SAND–95-1291C
	Pacific Northwest Lab., Richland, WA (United States)	
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AC06-87RL10930	**Westinghouse Hanford Co., Richland, WA (United States)**	
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	20:23276	WHC-SD-WM-DP–114
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	ICF Kaiser Hanford Co., Richland, WA (United States)	
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AC06-93RL12367	**USDOE, Washington, DC (United States)**	
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AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls, ID (United States)**	
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AC07-84ID12435	**Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States)**	
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AC07-94ID13223	**Lockheed Idaho Technologies Co., Idaho Falls, ID (United States)**	
	20:23122	DOE/MC/13223–95/C0484
AC08-87NV10576	**Science Applications International Corp., Las Vegas, NV (United States)**	
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AC08-90NV10845	**Nevada Univ., Reno, NV (United States). Desert Research Inst.**	
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AC08-93NV11265	**EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations**	
	20:24984	ESTSC–001048IBMPC00
AC08-94NV11432	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States)**	
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AC09-76SR00819	**Savannah River Ecology Lab., Aiken, SC (United States)**	
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	Westinghouse Savannah River Co., Aiken, SC (United States)	
	20:24615	WSRC-MS–94-0528
AC09-89SR18035	**Pacific Northwest Lab., Richland, WA (United States)**	
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	Westinghouse Savannah River Co., Aiken, SC (United States)	
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AC11-93PN38195	Bettis Atomic Power Lab., West Mifflin, PA (United States)	
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	Purdue Univ., Lafayette, IN (United States)	
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	Westinghouse Electric Corp., West Mifflin, PA (United States). Bettis Atomic Power Lab.	
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AC12-76SN00052	KAPL, Inc., Schenectady, NY (United States)	
	20:24399	PATENTS-US--A8058850
AC21-86MC21023	Foster Wheeler Development Corp., Livingston, NJ (United States)	
	20:23028	DOE/MC/21023--4008-Vol.1
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AC21-89MC26026	West Virginia Coll., Beckley, WV (United States)	
	20:23115	DOE/MC/26026--95/C0482
AC21-89MC26288	Manufacturing and Technology Conversion International, Inc., Columbia, MD (United States)	
	20:23015	DOE/MC/26288--4060
AC21-90MC26025	Petroleum Consulting Services, Canton, OH (United States)	
	20:23114	DOE/MC/26025--95/C0475
AC21-90MC27346	K and M Engineering and Consulting Corp., Washington, DC (United States)	
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AC21-91MC28162	Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research	
	20:23016	DOE/MC/28162--4015
AC21-92MC28133	Membrane Technology and Research, Inc., Menlo Park, CA (United States)	
	20:23116	DOE/MC/28133--95/C0485
AC21-92MC28182	Smith International, Inc., Houston, TX (United States)	
	20:23117	DOE/MC/28182--95/C0489
AC21-92MC29113	Mechanical Technology, Inc., Latham, NY (United States)	
	20:23981	DOE/MC--92113-4016
AC21-93MC30244	General Electric Co., Schenectady, NY (United States). Corporate Research and Development Center	
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AC21-94MC29249	KAI Technologies, Inc., Woburn, MA (United States)	
	20:23184	DOE/MC/29249--4074
AC21-94MC31112	Advanced Resources International, Inc., Arlington, VA (United States)	
	20:23126	DOE/MC/31112--95/C0488
AC21-94MC31224	Coleman Research Corp., Golden, CO (United States)	
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AC21-94MC31327	Black and Veatch, Kansas City, MO (United States)	
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AC22-86PC90011	SRI International, Menlo Park, CA (United States)	
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	20:23436	DOE/PC/90011--T2
	20:23437	DOE/PC/90011--T3
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	20:23440	DOE/PC/90011--T6
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	20:23442	DOE/PC/90011--T8
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AC22-86PC90278	Management and Technical Consultants, Inc., Columbia, MD (United States)	
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AC22-87PC79650	Thermo Electron Corp., Waltham, MA (United States)	
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AC22-87PC79669	MHD Development Corp., Butte, MT (United States)	
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AC22-87PC79903	Stanford Univ., CA (United States). High Temperature Gasdynamics Lab.	
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AC22-88ID12735	MSE, Inc., Butte, MT (United States)	
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AC22-89BC14477	Pennsylvania State Univ., University Park, PA (United States)	
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AC22-90BC14649	Southwest Research Inst., San Antonio, TX (United States)	
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AC22-90PC90054	Pennsylvania State Univ., University Park, PA (United States). Coll. of Earth and Mineral Sciences	
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	Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering	
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AC22-91PC91030	Dow Corning Corp., Carrollton, KY (United States)	
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AC22-91PC91043	Western Research Inst., Laramie, WY (United States)	
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AC22-91PC91058	Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research	
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AC22-92BC14881	Kansas Univ., Lawrence, KS (United States)	
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AC22-92BC14883	Illinois Inst. of Tech., Chicago, IL (United States)	
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AC22-92BC14884	Columbia Univ., New York, NY (United States)	
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AC22-92BC14885	Texas Univ., Austin, TX (United States). Center for Petroleum and Geosystems Engineering	
	20:23075	DOE/BC/14885--10
AC22-92MT92007	Rice Univ., Houston, TX (United States)	
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AC22-92MT92008	Pennsylvania State Univ., University Park, PA (United States)	
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AC22-92MT92009	Resource Technology Corp., Laramie, WY (United States)	
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AC22-92MT92010	Michigan Univ., Ann Arbor, MI (United States)	
	20:23103	DOE/MT/92010–10
	Michigan Univ., Ann Arbor, MI (United States). Dept. of Chemical Engineering	
	20:23102	DOE/MT/92010–8
AC22-92MT92011	Texas Univ., Austin, TX (United States)	
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AC22-92PC91155	United Technologies Corp., East Hartford, CT (United States). Research Center	
	20:23519	DOE/PC/91155–T10
AC22-92PC91338	Radian Corp., Austin, TX (United States)	
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AC22-92PC91344	SRI International, Menlo Park, CA (United States)	
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AC22-92PC91346	Carnegie-Mellon Univ., Pittsburgh, PA (United States). Center for Energy and Environmental Studies	
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AC22-92PC92108	Energy Research and Development International, Inc., Pittsburgh, PA (United States)	
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AC22-92PC92109	Altamira Instruments, Inc., Pittsburgh, PA (United States)	
	20:22993	DOE/PC/92109–T8
AC22-92PC92119	Geo-Microbial Technologies, Inc., Ochelata, OK (United States)	
	20:22994	DOE/PC/92119–T7
AC22-92PC92121	Utah Univ., Salt Lake City, UT (United States). Dept. of Chemical and Fuels Engineering	
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AC22-92PC92159	Combustion Engineering, Inc., Windsor, CT (United States). Power Plant Labs.	
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AC22-93BC14891	Colorado School of Mines, Golden, CO (United States). Dept. of Petroleum Engineering	
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AC22-93BC14892	Michigan Technological Univ., Houghton, MI (United States)	
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AC22-93BC14896	Utah Dept. of Natural Resources, Salt Lake City, UT (United States). Geological Survey Div.	
	20:23056	DOE/BC/14896–6
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AC22-93BC14897	Wyoming Univ., Laramie, WY (United States). Inst. for Energy Research	
	20:23077	DOE/BC/14897–7
AC22-93PC91029	Bechtel National, Inc., San Francisco, CA (United States)	
	20:22989	DOE/PC/91029–T7
AC22-94PC93069	Texas A and M Univ., College Station, TX (United States). Dept. of Chemical Engineering	
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AC24-92OR21972	Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States)	
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AC34-90RF62349	Rockwell International Corp., Golden, CO (United States)	
	20:24604	PATENTS-US–A8062512
	EG and G Rocky Flats, Inc., Golden, CO (United States)	
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	EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant	
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	Rocky Flats Environmental Technology Site, Golden, CO (United States)	
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	Safe Sites of Colorado, Golden, CO (United States)	
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AC35-89ER40486	Lawrence Berkeley Lab., CA (United States). SSC Central Design Group	
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	Superconducting Super Collider Lab., Dallas, TX (United States)	
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	20:24096	SSC-SR–1002
	20:24097	SSC-SR–1003
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	20:24288	SSCL-Preprint–221
	20:24289	SSCL-Preprint–270
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	20:24292	SSCL-Preprint–540
	20:24293	SSCL-Preprint–555
	20:24294	SSCL-Preprint–556
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	20:24373	SSCL-Preprint–553
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	20:24778	SSCL-Preprint–552
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AC35-83CH10093	Purdue Univ., Lafayette, IN (United States). School of Electrical Engineering	
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AI02-93ER61624	National Insts. of Health, Bethesda, MD (United States)	
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AI02-94ER61888	Resources for the Future, Inc., Washington, DC (United States). Dept. of Energy and Natural Resources	
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AI03-89SF17905	Jet Propulsion Lab., Pasadena, CA (United States)	
	20:23743	DOE/SF/17905–T10
AI05-90ER61070	USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div.	
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AI05-92ER54177	Department of the Navy, Washington, DC (United States)	
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AI05-92OR22041	National Inst. of Standards and Technology (MSEL), Gaithersburg, MD (United States). Ceramics Div.	
	20:23890	DOE/OR/22041–T2
AI05-93OR22089	Geological Survey, Menlo Park, CA (United States)	
	20:23495	USGS-OFR–94-586
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AI08-92NV10874	Geological Survey, Denver, CO (United States)	
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AI79-84BP11982	National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.	
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AI79-89BP00276	National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.	
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AI79-91BP21708	National Biological Survey, Cook, WA (United States). Columbia River Research Lab.	
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AI79-92BP41841	National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.	
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AI79-93BP10891	National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.	
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AM79-92BP25105	Mobrand Biometrics, Inc., Vashon Island, WA (United States)	
	20:23457	DOE/BP/25105–2
AS09-80ER10690	South Carolina Univ., Columbia, SC (United States)	
	20:24774	DOE/ER/10690–11
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BI79-83BP11631	Idaho Dept. of Fish and Game, Boise, ID (United States)	
	20:23454	DOE/BP/11631–10
BI79-87BP35768	Confederated Tribes of the Umatilla Indian Reservation, Pendleton, OR (United States). Dept. of Natural Resources	
	20:23458	DOE/BP/35768–4
	20:23459	DOE/BP/35768–5
BI79-88BP91819	Eastern Washington Univ., Cheney, WA (United States). Upper Columbia United Tribes Fisheries Research Center	
	20:23461	DOE/BP/91819–10
BI79-88BP92818	Oregon State Univ., Corvallis, OR (United States). Dept. of Fisheries and Wildlife	
	20:24627	DOE/BP/92818–4
BI79-88BP93743	Kootenai Tribe of Idaho, Bonners Ferry, ID (United States)	
	20:23462	DOE/BP/93743–1
BI79-89BP01385	Oregon Dept. of Fish and Wildlife, Portland, OR (United States)	
	20:23451	DOE/BP/01385–5
BI79-91BP21182	Idaho Dept. of Fish and Game, Boise, ID (United States). Fisheries Research Section	
	20:23456	DOE/BP/21182–5
BI79-92BP27938	Idaho Univ., Moscow, ID (United States)	
	20:24032	CONF-940702–1
FC02-88CE40839	Institute of Paper Science and Technology, Atlanta, GA (United States)	
	20:23780	DOE/CE/40839–T3
FC02-91ID13052	TENSA Services, Houston, TX (United States)	
	20:23752	DOE/ID/13052–1
FC03-92SF19460	Rochester Univ., NY (United States). Lab. for Laser Energetics	
	20:24858	DOE/SF/19460–58
FC04-92AL82993	Pacific Gas and Electric Co., San Ramon, CA (United States). Dept. of Research and Development	
	20:23480	DOE/AL/82993–13
	20:23481	DOE/AL/82993–19
	20:23482	DOE/AL/82993–22
	20:23494	DOE/AL/82993–12
	20:23654	DOE/AL/82993–9
FC04-93AL94598	South Carolina Research Authority, North Charleston, SC (United States)	
	20:23777	DOE/AL–94598-1
FC04-94AL98817	International Business Machines Corp., Endicott, NY (United States)	
	20:24034	DOE/AL/98817–3
FC04-95AL85832	Texas Univ., Austin, TX (United States). Center for Research in Water Resources	
	20:24569	DOE/AL/85832–T4
	Amarillo National Resource Center for Plutonium, TX (United States)	
	20:23382	DOE/AL/85832–T3
	20:23383	DOE/AL/85832–T6
	20:23384	DOE/AL/85832–T7
	20:24570	DOE/AL/85832–T5
FC07-91ID13074	Kansas State Univ., Manhattan, KS (United States)	
	20:23814	DOE/ID/13074–T16
FC07-93ID13236	Wisconsin Univ., Milwaukee, WI (United States)	
	20:23911	DOE/ID/13236–T1
FC08-90NV10872	Nevada Univ., Las Vegas, NV (United States)	
	20:23173	CONF-950570–24
FC08-90NV10891	Lawrence Livermore National Lab., CA (United States)	
	20:23250	UCRL-JC–120957

Contract No.	Abstract No.	Report No.
FC09-88SR15199	South Carolina Univ., Columbia, SC (United States). Savannah River Archaeological Research Program	
	20:23412	DOE/SR/15199–7
FC21-89MC26042	American Electric Power Service Corp., Columbus, OH (United States)	
	20:23014	DOE/MC/26042–4059
FC21-90MC25140	Southern Co. Services, Inc., Birmingham, AL (United States)	
	20:23013	DOE/MC/25140–4053
FC21-90MC27229	Thermochem, Inc., Columbia, MD (United States)	
	20:23030	DOE/MC/27229–4055
FC21-92MC27391	Kerr-McGee Coal Corp., Oklahoma City, OK (United States)	
	20:22984	DOE/MC/27391–4057
FC21-92MC29077	Oklahoma Univ., Norman, OK (United States). School of Petroleum and Geological Engineering	
	20:23118	DOE/MC/29077–95/C0490
FC21-92MC29309	Sierra Pacific Power Co., Reno, NV (United States)	
	20:23516	DOE/MC/29309–4056
	20:23517	DOE/MC/29309–4063
FC21-92MC29467	National Research Center for Coal and Energy, Morgantown, WV (United States)	
	20:23351	DOE/MC/29467–4080
FC21-93MC30127	Western Research Inst., Laramie, WY (United States)	
	20:23090	DOE/MC/30127–4061
	20:23091	DOE/MC/30127–4062
FC21-93MC30251	Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research	
	20:23017	DOE/MC/30251–4068
FC21-93MC30252	Southern Illinois Univ., Carbondale, IL (United States). Dept. of Mining Engineering	
	20:23018	DOE/MC/30252–4077
FC22-89PC88697	Pennsylvania State Univ., University Park, PA (United States). Energy and Fuels Research Center	
	20:23034	DOE/PC/88697–T11
FC22-93BC14953	Utah Dept. of Natural Resources, Salt Lake City, UT (United States). Geological Survey Div.	
	20:23058	DOE/BC/14953–10
FC22-93BC14954	Diversified Operating Corp., Denver, CO (United States)	
	20:23059	DOE/BC/14954–5
FC22-93BC14957	Kansas Univ. Center for Research, Inc., Lawrence, KS (United States)	
	20:23083	DOE/BC/14957–8
FC22-93BC14959	Texas Univ., Austin, TX (United States)	
	20:23060	DOE/BC/14959–13
FC22-93BC14960	Texaco Exploration and Production, Inc., New Orleans, LA (United States)	
	20:23084	DOE/BC/14960–8
	Texaco Exploration and Production, Inc., Bridge City, TX (United States)	
	20:23085	DOE/BC/14960–9
FC22-93BC14961	Columbia Univ., Palisades, NY (United States). Lamont-Doherty Earth Observatory	
	20:23061	DOE/BC/14961–7
FC22-93BC14963	Amoco Production Co., Houston, TX (United States)	
	20:23087	DOE/BC/14963–8
FC22-93PC92578	Missouri Univ., Columbia, MO (United States)	
	20:23026	DOE/PC/92578–T8
FC22-93PC93053	Consortium for Fossil Fuel Liquefaction Science, Lexington, KY (United States)	
	20:22997	DOE/PC/93053–T3
FC22-94BC14962	Hughes Eastern Corp., Jackson, MS (United States)	
	20:23086	DOE/BC/14962–7
FC22-94BC14982	Laguna Petroleum Corp., Midland, TX (United States)	
	20:23062	DOE/BC/14982–3
FC22-94PC94116	Acurex Environmental Corp., Research Triangle Park, NC (United States)	
	20:23041	DOE/PC/94116–T4
FC36-94GO10039	Clean Air Now, Venice, CA (United States)	
	20:23414	DOE/GO/10039–1
FG01-91CE15452	Missouri Univ., Rolla, MO (United States)	
	20:23778	DOE/CE/15452–T1
FG01-92CE15544	South Dakota State Univ., Brookings, SD (United States)	
	20:23417	DOE/CE/15544–T11
FG01-92EW50625	Medical Univ. of South Carolina, Charleston, SC (United States)	
	20:24715	CONF-950430–6
	20:24729	DOE/EW/50625–T22
	20:24730	DOE/EW/50625–T23
	20:24731	DOE/EW/50625–T24
FG01-94CE15605	DCS Corp., Alexandria, VA (United States)	
	20:24398	DOE/CE/15605–T3
FG01-94EH89439	USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance	
	20:23587	NUREG/CP–0141
FG01-95EE15623	EnerTech Environmental, Inc., Atlanta, GA (United States). Engineering Group	
	20:23515	DOE/EE/15623–T1
FG02-85ER13442	Michigan Univ., Ann Arbor, MI (United States). Dept. of Atmospheric, Oceanic and Space Sciences	
	20:23954	DOE/ER/13442–9
FG02-85ER53198	Wisconsin Univ., Madison, WI (United States). Plasma Physics Research	
	20:24860	DOE/ER/53198–261
FG02-86ER13460	Yale Univ., New Haven, CT (United States). Dept. of Chemistry	
	20:23955	DOE/ER/13460–2
	20:23956	DOE/ER/13460–T3
FG02-86ER45229	Argonne National Lab., IL (United States)	
	20:23834	ANL/MSD/CP–83449
FG02-86ER45278	Cornell Univ., Ithaca, NY (United States)	
	20:23910	DOE/ER/45278–T4
	20:24035	DOE/ER/45278–4
	Cornell Univ., Ithaca, NY (United States). Dept. of Materials Science and Engineering	
	20:23909	DOE/ER/45278–T3
FG02-86ER60397	East Anglia Univ., Norwich (United Kingdom). Climatic Research Unit	
	20:24532	DOE/ER/60397–7
FG02-86ER60455	Oakland Univ., Rochester, MI (United States)	
	20:24717	DOE/ER/60455–8
	20:24718	DOE/ER/60455–9
FG02-86NE37967	Florida Univ., Gainesville, FL (United States)	
	20:23982	DOE/NE/37967–T10
FG02-86NE37969	Michigan Univ., Ann Arbor, MI (United States)	
	20:23786	DOE/NE/37969–6
FG02-87CH10330	Alabama A and M Univ., Normal, AL (United States)	
	20:24716	DOE/CH/10330–T1

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FG02-87ER13670	Arizona Univ., Tucson, AZ (United States). Dept. of Physics	
	20:24761	DOE/ER/13670–T5
FG02-87ER13712	Wisconsin Univ., Madison, WI (United States). Dept. of Plant Pathology	
	20:23421	DOE/ER/13712–4
FG02-88ER13937	Columbia Univ., New York, NY (United States)	
	20:24839	DOE/ER/13937–7
FG02-88ER13969	Arizona State Univ., Tempe, AZ (United States)	
	20:23468	DOE/ER/13969–3
FG02-88ER40408	Lawrence Berkeley Lab., CA (United States)	
	20:24825	LBL–36370
FG02-88ER40412	Lawrence Berkeley Lab., CA (United States)	
	20:24825	LBL–36370
FG02-88ER75388	Virginia Univ., Charlottesville, VA (United States). School of Engineering and Applied Science	
	20:23131	DOE/ER/75388–T1
FG02-89ER12900	Illinois Univ., Urbana, IL (United States). Dept. of Nuclear Engineering	
	20:23615	DOE/ER/12900–1
FG02-89ER14045	Rensselaer Polytechnic Inst., Troy, NY (United States)	
	20:24020	DOE/ER/14045–10
FG02-89ER14084	Massachusetts Inst. of Tech., Cambridge, MA (United States). Earth Resources Lab.	
	20:23066	DOE/ER/14084–4
FG02-89ER40531	Lawrence Berkeley Lab., CA (United States)	
	20:24825	LBL–36370
FG02-89ER53299	Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center	
	20:24861	DOE/ER/53299–1
FG02-90ER13031	Texas A and M Univ., College Station, TX (United States). Texas Engineering Experiment Station	
	20:24828	DOE/ER/13031–T1
FG02-90ER61058	Wisconsin Univ., Madison, WI (United States)	
	20:24382	CONF-930346–6
FG02-90ER61064	USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div.	
	20:24471	CONF-940277–
FG02-90ER61065	USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div.	
	20:24464	CONF-940277–
FG02-91CE23810	Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States)	
	20:23779	DOE/CE/23810–60
	20:23952	DOE/CE/23810–46
	20:23979	DOE/CE/23810–51F
	20:23980	DOE/CE/23810–59
	20:24027	DOE/CE/23810–62A
FG02-91ER40678	Michigan State Univ., East Lansing, MI (United States)	
	20:24351	DOE/ER/40678–T2
FG02-91ER61218	Colorado State Univ., Fort Collins, CO (United States). Dept. of Atmospheric Science	
	20:24452	CONF-930133–12
FG02-91ER75665	Wyoming Univ., Laramie, WY (United States)	
	20:24926	DOE/ER/75665–2
	20:24927	DOE/ER/75665–3
FG02-92ER54141	Lawrence Livermore National Lab., CA (United States)	
	20:24881	UCRL-JC–119843
FG02-92ER61361	USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div.	
	20:24504	CONF-940277–
FG02-92ER75712	Argonne National Lab., Idaho Falls, ID (United States)	
	20:23612	ANL/IFR/CP–85456
FG02-93ER14379	Electro Energy, Inc., Danbury, CT (United States)	
	20:23667	DOE/ER/14379–T1
FG02-93ER40771	Pennsylvania State Univ., University Park, PA (United States). Dept. of Physics	
	20:24787	DOE/ER/40771–T1
FG02-93ER61574	Johns Hopkins Univ., Baltimore, MD (United States)	
	20:24714	CONF-9304293–
FG02-93ER61666	Michigan Univ., Ann Arbor, MI (United States). School of Natural Resources and Environment	
	20:24728	DOE/ER/61666–2
FG02-93ER75873	Illinois Univ., Urbana, IL (United States)	
	20:24758	DOE/ER/75873–T1
FG02-94ER25212	Kansas Univ., Lawrence, KS (United States)	
	20:24649	DOE/ER/25212–T1
FG02-94ER61789	Building Services Research and Information Association, Bracknell (United Kingdom). Building Energy Management Systems (BEMS) Centre	
	20:24739	DOE/ER/61789–1
FG02-94ER61792	Michigan Univ., Ann Arbor, MI (United States)	
	20:24682	DOE/ER/61792–1
FG02-94ER61838	Cold Spring Harbor Lab., NY (United States)	
	20:24642	CONF-9406343–Absts.
FG02-94ER76002	United States Export Council for Renewable Energy, Washington, DC (United States)	
	20:23675	CONF-9410353–Exc.
FG02-94PO10221	Western Interstate Energy Board, Denver, CO (United States)	
	20:23637	DOE/PO/10221–T1
FG03-86ER53225	Oak Ridge National Lab., TN (United States)	
	20:24859	CONF-9505105–6
FG03-86ER60406	Los Alamos National Lab., NM (United States)	
	20:24688	LA–12893-C
FG03-87ER13662	Stanford Univ., CA (United States)	
	20:23908	DOE/ER/13662–T3
FG03-87ER13757	Stanford Univ., CA (United States). Dept. of Civil Engineering	
	20:24019	DOE/ER/13757–T6
FG03-90ER61061	USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div.	
	20:24508	CONF-940277–
FG03-90ER81080	Duly Consultants, Rancho Palos Verdes, CA (United States)	
	20:24108	CONF-910505–443
	20:24109	CONF-910505–444
	20:24110	CONF-910505–445
FG03-91ER61165	University of Southern California, Los Angeles, CA (United States)	
	20:24641	CONF-9104300–Absts.

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FG03-91ER61252	California Univ., Los Angeles, CA (United States)	
	20:24696	DOE/ER/61252–T2
FG03-92ER25140	Lawrence Livermore National Lab., CA (United States)	
	20:24024	UCRL-JC–118609
FG03-93ER14315	Utah Univ., Salt Lake City, UT (United States). Dept. of Metallurgical Engineering	
	20:23943	DOE/ER/14315–T2
FG03-93ER40759	Stanford Linear Accelerator Center, Menlo Park, CA (United States)	
	20:24282	SLAC-PUB–95-6906
	20:24337	SLAC-PUB–95-6901
FG03-93ER75884	Texas A and M Univ., College Station, TX (United States). Texas Engineering Experiment Station	
	20:23595	DOE/ER/75884–T1
FG03-93SF19888	Oregon Graduate Inst. of Science and Technology, Portland, OR (United States). Dept. of Electrical Engineering and Applied Physics	
	20:23913	DOE/SF/19888–T1
FG03-94ER54241	Texas Univ., Austin, TX (United States). Fusion Research Center	
	20:24862	DOE/ER/54241–2
FG03-94ER61749	USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div.	
	20:24464	CONF-940277–
FG03-94ER61772	USDOE Office of Energy Research, Washington, DC (United States). Environmental Sciences Div.	
	20:24482	CONF-940277–
FG03-94ER81741	Lawrence Berkeley Lab., CA (United States)	
	20:24903	LBL–36487
FG03-94ER81775	Haimson Research Corp., Santa Clara, CA (United States)	
	20:24184	CONF-661021–1
FG03-95ER45529	California Univ., San Diego, La Jolla, CA (United States)	
	20:23851	DOE/ER–45529
FG04-95AL87310	Pennsylvania State Univ., University Park, PA (United States)	
	20:23127	DOE/AL/87310–1
FG05-80ET53088	Texas Univ., Austin, TX (United States). Inst. for Fusion Studies	
	20:24863	DOE/ET/53088–701
	20:24980	DOE/ET/53088–689
FG05-85ER13439	Rice Univ., Houston, TX (United States). Dept. of Chemistry	
	20:23953	DOE/ER/13439–T5
FG05-86ER40272	Florida Univ., Gainesville, FL (United States)	
	20:24776	DOE/ER/40272–213
FG05-86ER75281	Los Alamos National Lab., NM (United States)	
	20:24688	LA–12893-C
FG05-87ER40314	Lawrence Berkeley Lab., CA (United States)	
	20:24826	LBL–37201
FG05-88ER40437	Lawrence Berkeley Lab., CA (United States)	
	20:24825	LBL–36370
FG05-88ER60649	Oak Ridge National Lab., TN (United States)	
	20:24698	CONF-9505232–1
FG05-89ER40530	Tennessee Technological Univ., Cookeville, TN (United States). Dept. of Physics	
	20:24851	CONF-9408180–3
FG05-89ER75506	Western Research Inst., Laramie, WY (United States)	
	20:22980	DOE/PC/91043–T13
FG05-92ER25138	Florida Inst. of Tech., Melbourne, FL (United States). Dept. of Mechanical and Aerospace Engineering	
	20:24979	DOE/ER/25138–T1
FG05-93ER14402	Georgia Univ., Athens, GA (United States). Dept. of Chemistry	
	20:24837	DOE/ER/14402–7
FG05-93ER75860	Sigma Xi, the Scientific Research Society, Inc., Durham, NC (United States)	
	20:23674	CONF-9302211–Summ.
FG06-90ER40537	Washington Univ., Seattle, WA (United States)	
	20:24762	DOE/ER/40537–43
	Washington Univ., Seattle, WA (United States). Nuclear Physics Lab.	
	20:24805	DOE/ER/40537–37
FG06-90ER40561	Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory	
	20:24782	DOE/ER/40561–193
FG06-92ER79148	Reed Coll., Portland, OR (United States)	
	20:23596	DOE/ER/79148–T1
FG06-93ER25181	Washington Univ., Seattle, WA (United States)	
	20:24847	DOE/ER/25181–T1
FG07-93ER75912	Pacific Northwest Lab., Richland, WA (United States)	
	20:24609	PNL-SA–25679
FG09-85ER60376	North Carolina State Univ., Raleigh, NC (United States). Dept. of Marine, Earth and Atmospheric Sciences	
	20:24628	DOE/ER/60376–T4
FG09-86ER13602	Georgia Univ., Athens, GA (United States). Research Foundation	
	20:24681	DOE/ER/13602–7
FG09-86ER13614	Georgia Univ., Athens, GA (United States). Research Foundation	
	20:23419	DOE/ER/13614–T3
	20:23420	DOE/ER/13614–T4
FG09-88ER13970	Georgia Univ., Athens, GA (United States). Complex Carbohydrate Research Center	
	20:24644	DOE/ER/13970–T2
	Georgia Univ., Athens, GA (United States). Research Foundation	
	20:24645	DOE/ER/13970–T3
FG09-88SR18048	Claflin Coll., Orangeburg, SC (United States)	
	20:24928	DOE/SR/18048–4
FG09-89ER14059	Georgia Univ., Athens, GA (United States)	
	20:23422	DOE/ER/14059–2
	Georgia Univ., Athens, GA (United States). Research Foundation	
	20:23418	DOE/ER/14059–T1
FG09-89ER14071	Georgia Univ., Athens, GA (United States). Research Foundation	
	20:24646	DOE/ER/14071–4
FG09-90ER61040	South Carolina Univ., Columbia, SC (United States)	
	20:24651	DOE/ER/61040–4
	20:24652	DOE/ER/61040–T1
	South Carolina Univ., Columbia, SC (United States). Dept. of Biological Sciences	
	20:24650	DOE/ER/61040–3
FG09-90SR18159	Claflin Coll., Orangeburg, SC (United States)	
	20:24582	DOE/SR/18159–4

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FG09-91ER20034	Georgia Univ., Athens, GA (United States). Dept. of Botany	
	20:24647	DOE/ER/20034–2
	20:24648	DOE/ER/20034–3
FG09-91SR18217	Medical Univ. of South Carolina, Charleston, SC (United States). Dept. of Biometry and Epidemiology	
	20:23355	DOE/SR/18217–4
FG21-88MC25031	Texas Univ., Austin, TX (United States). Bureau of Economic Geology	
	20:23113	DOE/MC–25031-95/C0453
FG21-92MC29228	Lehigh Univ., Bethlehem, PA (United States)	
	20:23433	DOE/MC/29228–4070
FG21-94MC31162	Texas A and M Univ., Kingsville, TX (United States). Dept. of Chemical and Natural Gas Engineering	
	20:23119	DOE/MC/31162–95/C0465
FG22-91PC91297	Clarkson Univ., Potsdam, NY (United States)	
	20:23025	DOE/PC/91297–T10
FG22-91PC91304	Pittsburgh Univ., PA (United States). Dept. of Chemical and Petroleum Engineering	
	20:22991	DOE/PC/91304–T13
FG22-91PC91310	Western Research Inst., Laramie, WY (United States)	
	20:22980	DOE/PC/91043–T13
FG22-92MT92020	North Carolina Agricultural and Technical State Univ., Greensboro, NC (United States). Dept. of Chemical Engineering	
	20:23094	DOE/MT/92020–10
FG22-92PC92104	Pennsylvania State Univ., University Park, PA (United States). Coll. of Earth and Mineral Sciences	
	20:23002	DOE/PC/92104–T10
FG22-92PC92529	Notre Dame Univ., IN (United States). Dept. of Chemical Engineering	
	20:22996	DOE/PC/92529–T10
FG22-92PC92542	Lehigh Univ., Bethlehem, PA (United States). Energy Research Center	
	20:23852	DOE/PC/92542–T10
FG22-92PC92543	Pennsylvania State Univ., University Park, PA (United States)	
	20:22981	DOE/PC/92543–T10
FG22-93BC14862	Stanford Univ., CA (United States). Dept. of Petroleum Engineering	
	20:23071	DOE/BC/14862–10
FG22-93BC14864	Alaska Univ., Fairbanks, AK (United States)	
	20:23072	DOE/BC/14864–14
FG22-93BC14899	Stanford Univ., CA (United States)	
	20:23078	DOE/BC/14899–24
	20:23081	DOE/BC/14899–27
	Stanford Univ., CA (United States). Petroleum Research Inst.	
	20:23082	DOE/BC/14899–28
	University of Southern California, Los Angeles, CA (United States). Dept. of Chemical Engineering	
	20:23079	DOE/BC/14899–25
	20:23080	DOE/BC/14899–26
FG22-93PC93202	Alabama Univ., University, AL (United States). Dept. of Chemistry	
	20:23003	DOE/PC/93202–6
FG22-93PC93219	Duke Univ., Durham, NC (United States). Dept. of Mechanical Engineering and Materials Science	
	20:23891	DOE/PC/93219–T5
FG22-93PC93220	Cincinnati Univ., OH (United States). Dept. of Chemical Engineering	
	20:23001	DOE/PC/93220–T6
FG22-94BC14858	National Academy of Sciences, Washington, DC (United States)	
	20:24744	DOE/BC/14858–2
FG22-94BC14971	Oklahoma Univ., Norman, OK (United States). Dept. of Aerospace and Mechanical Engineering	
	20:23128	DOE/BC/14971–3
FG22-94PC94122	Prairie View A and M Univ., TX (United States)	
	20:23042	DOE/PC/94122–T2
FG22-94PC94222	Texas Univ., Richardson, TX (United States). Dept. of Chemistry	
	20:23912	DOE/PC/94222–2
FG36-94GO10044	Enermodal Engineering, Inc., Denver, CO (United States)	
	20:23751	DOE/GO/10044–1
FG42-93R215469	Thermecon, Champlain, NY (United States)	
	20:23753	DOE/R2/15469–T8
FG44-91R410591	National Renewable Energy Lab., Golden, CO (United States)	
	20:23423	DOE/R4/10591–1
FG44-93R410610	Southface Energy Inst., Inc., Atlanta, GA (United States)	
	20:23754	DOE/R4/10610–T1
FG47-93R701314	Welch (James D.), Omaha, NE (United States)	
	20:24036	DOE/R7/01314–T7
W-31-109-ENG-38	Argonne National Lab., Idaho Falls, ID (United States)	
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85016	20:24101	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013437	MF-406
85017	20:24102	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013752	MF-411
85045	20:24061	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013751	MF-411
85046	20:24103	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013700	MF-411
85048	20:24165	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013758	MF-411
85051	20:24166	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013759	MF-411
85055	20:24104	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013760	MF-411
85056	20:24167	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013761	MF-411
85063	20:24168	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013779	MF-411
85065	20:24169	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013780	MF-411
85097	20:24170	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013782	MF-411
ANL/CHM/CP–					
84380	20:24853	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012275	MF-411
85693	20:23971	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013404	MF-401
85752	20:23938	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012269	MF-401
86330	20:24854	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012273	MF-404
86590	20:23898	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013772	MF-401
86617	20:24950	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013463	MF-401; MF-405
86825	20:23970	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014233	MF-401
ANL/CMT-ACL/VU–					
83596	20:24442	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013496	MF-2000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ANL/CMT/CP–					
84524	20:23160	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014235	MF-2070
84525	20:23899	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013442	MF-2030
84526	20:23161	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013781	MF-902
84590	20:23162	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013773	MF-2020
84591	20:23163	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013693	MF-2070
84717	20:23164	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013890	MF-2020
84719	20:23900	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013466	MF-2020; MF-804
84722	20:23901	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013465	MF-904
84826	20:23950	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012946	MF-404
85327	20:23811	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012469	MF-1501
85790	20:23745	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013408	MF-528
86025	20:23165	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014080	MF-2070
86433	20:23166	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014242	MF-2000
ANL/CMT/PP–					
80445	20:24557	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013551	MF-702
ANL/DIS/CP–					
84269	20:23336	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013684	MF-700; MF-2000
84688	20:24441	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013420	MF-407
85160	20:23315	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013370	MF-2000
85699	20:24406	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013676	
85733	20:23726	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013786	MF-101
86453	20:23825	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011827	MF-400
86615	20:25020	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014224	MF-905
ANL/DIS/RP–					
85600	20:23772	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014658	
ANL/EA/CP–					
83912	20:23687	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013421	MF-900
83975	20:23068	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012279	MF-902
84325	20:24558	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012926	
84766	20:23167	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011818	MF-2050
84904	20:24444	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013683	MF-2010
85472	20:24559	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013500	MF-2070
86212	20:24951	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013413	MF-2000
86344	20:24560	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012272	MF-902
ANL/EA/SUMM–					
84723	20:23688	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013435	MF-2000
ANL/EAD/TM–					
4	20:23446	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015177	MF-920
5	20:23447	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016231	MF-900
6	20:23448	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016232	MF-900
10	20:23449	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016233	MF-902
38-Vol.1	20:24561	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011643	
39	20:24562	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011641	
45	20:24563	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015178	
ANL/ED/CP–					
84176	20:23580	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013419	MF-940
85916	20:23534	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014220	MF-505
86766	20:24062	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014232	MF-506
ANL/EQO/SUMM–					
85950	20:24713	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013516	MF-630
ANL/EQO/VU–					
86239	20:23168	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013412	MF-902

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ANL/ER/CP–					
84198	20:24445	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012265	MF-402
85219	20:24446	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012266	MF-402
86001	20:24447	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012401	MF-402
86626	20:24448	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013464	MF-402
ANL/ER/PP–					
81214	20:24838	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013494	MF-411
ANL/ES/CP–					
82597	20:23773	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013469	MF-1419
83898	20:24449	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013388	MF-1500
84366	20:23831	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012290	MF-1419
84609	20:23520	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013530	MF-105
85247	20:23337	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013690	MF-2010
85485	20:23809	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013492	MF-406
85486	20:23109	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013493	MF-132
86536	20:23338	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013719	MF-2010
ANL/ESD–					
27	20:23812	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014763	MF-1501
ANL/ET/CP–					
82236	20:24757	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012271	MF-1394
82671	20:23975	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013687	MF-424
83008	20:23611	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013682	MF-533
83253	20:23148	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012532	MF-2070
84157	20:23565	OSTI; NTIS; INIS		TI95014245	
84607	20:23939	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014222	MF-901
84772	20:23665	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014223	MF-1394
85044	20:24450	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014228	MF-902; MF-402
85328	20:23880	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013498	MF-1303
85947	20:23774	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013764	MF-400
86059	20:23881	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013783	MF-117
86147	20:23832	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013531	MF-114; MF-404
ANL/EWM/CP–					
82616	20:23169	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012940	MF-2010
ANL/FE/CP–					
85555	20:23554	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012278	MF-535
ANL/IFR/CP–					
82835	20:23555	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012932	MF-533
82925	20:23556	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012931	MF-537
83964	20:23581	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013471	MF-539
84087	20:23591	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013402	MF-520
84088	20:23592	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013401	MF-520
84612	20:24018	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014081	MF-940
85456	20:23612	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012283	MF-405
ANL/IFR/SUMM–					
85396	20:23582	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014234	MF-940
ANL/IPNS/CP–					
86627	20:24344	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013738	MF-404; MF-406
ANL/ITD/PC–					
86699	20:23882	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013396	MF-1406
ANL/MCS-TM–					
195	20:24955	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014521	MF-405
207	20:24956	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012980	MF-405
ANL/MCS/CP–					
86036	20:24952	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013383	MF-405
86446	20:24953	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014244	MF-405
86648	20:24954	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013441	MF-405

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ANL/MSD/CP–					
82694	20:24855	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013755	MF-404
83449	20:23834	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012400	MF-404
86064	20:23902	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013389	MF-404
ANL/NDM–					
132	20:24814	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013544	MF-413
ANL/OTD-PR/CP–					
86451	20:25021	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013695	MF-405; MF-401
ANL/PHY/CP–					
85352	20:24105	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013784	MF-411
85353	20:24172	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013785	MF-411
85355	20:24173	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013757	MF-413
85476	20:24106	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013524	MF-413
86550	20:24174	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013777	MF-411
ANL/RA/CP–					
82800	20:23577	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012289	MF-532
85716	20:23763	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012268	MF-506; MF-1500
86533	20:23564	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013789	MF-505
ANL/RE/CP–					
85732	20:23566	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013403	MF-406
85743	20:24741	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014238	MF-2000
85754	20:23339	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014239	MF-526
86223	20:24957	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014248	MF-505
86314	20:24958	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014243	MF-405
86315	20:24959	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013520	MF-538
86338	20:24742	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014247	MF-538
ANL/TD/CP–					
85060	20:24175	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013769	MF-400
85177	20:23406	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014225	MF-900
85179	20:23543	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013406	MF-940
ANL/XFD/CP–					
83323	20:23835	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013385	MF-404
85084	20:24176	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013414	MF-406
86468	20:24177	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013767	MF-411
APS–					
3.3.2.1.0	20:24178	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013557	MF-400
BNL–					
52445-Rev.1-(FORMAL)	20:23613	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011784	MF-507
52447	20:24930	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013317	MF-900
52454	20:23976	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012092	PC-406
60119	20:23069	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000159	PC-122
60690	20:23381	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014520	MF-940
61191	20:24300	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011806	MF-414
61222	20:24063	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011804	MF-414
61285	20:23499	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011805	MF-1245
61332-(Rev.4/95)	20:24381	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011781	MF-406
61362	20:24179	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015370	MF-414
61395	20:23829	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013318	MF-906
61458	20:23586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014518	MF-403; MF-2000
61495	20:24107	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013510	MF-411
61553	20:24059	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014519	MF-400
61619	20:24451	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011350	MF-607
61647	20:23170	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011776	MF-2030
61673	20:23836	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011780	MF-701
61687	20:24345	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012086	MF-414
61702	20:23673	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013512	MF-900
61710	20:24743	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011783	MF-403
61738	20:23711	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013259	MF-405
61777	20:24180	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011816	MF-414
61801	20:24617	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013511	MF-501
61802	20:23951	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013312	MF-411
61827	20:24618	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013314	MF-403; MF-402

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61848	20:24301	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013234	MF-406
61850	20:24181	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013232	MF-400
61853	20:24302	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013486	MF-411
61859	20:24182	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013592	MF-400
61876	20:24064	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015367	MF-414
61912	20:24806	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014642	MF-413
61913	20:24807	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014641	MF-413
61919	20:24697	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014552	MF-408
61920	20:24183	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014551	MF-414
61928	20:24836	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014450	MF-401
61987	20:23096	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015403	MF-100
95012534	20:23535	OSTI; NTIS; INIS; GPO		TI95012534	
BNL-NUREG–					
52399-Vol.6-Pt.1	20:23588	*See* NUREG/CR–6144-Vol.6-Pt.1			
52399-Vol.6-Pt.2	20:23629	*See* NUREG/CR–6144-Vol.6-Pt.2			
52410	20:23628	*See* NUREG/CR–5954			
61712	20:23583	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011778	
61715	20:23584	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011779	
61789	20:23567	OSTI; NTIS; INIS		TI95013313	
BNWL-D–					
260	20:25022	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012661	MF-500
CAO–					
94-1005-Rev.1	20:23180	*See* DOE/CAO–2056-Vol.3-Draft			
94-1005-Rev.1	20:23181	*See* DOE/CAO–2056-Vol.4-Draft			
94-1010	20:23171	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012993	MF-2070
CERN-SL–					
92-02(AP)	20:24148	*See* SSCL–564			
CIEMAT–					
755	20:24882	OSTI; NTIS; INIS		DE95780844	
756	20:24781	OSTI; NTIS; INIS		DE95780846	
758	20:24346	OSTI; NTIS; INIS		DE95780845	
760	20:23940	OSTI; NTIS; INIS		DE95780847	
CONF-661021–		(Linear accelerator conference; Los Alamos, NM (United States); 3-7 Oct 1966)			
1	20:24184	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016114	MF-406
CONF-841263–		(Workshop on reliability in accelerator operations; Superconductor Super Collider (SSC) seminar on industry and high energy physics; Ann Arbor, MI (United States); Ann Arbor, MI (United States); 6 Dec 1984; 7 jan 1985)			
EXC	20:24099	*See* SSC-SR–1008			
CONF-8501128–		(Workshop on reliability in accelerator operations; Superconductor Super Collider (SSC) seminar on industry and high energy physics; Ann Arbor, MI (United States); Ann Arbor, MI (United States); 6 Dec 1984; 7 jan 1985)			
EXC	20:24099	*See* SSC-SR–1008			
CONF-8611319–		(Superconducting Super Collider magnet measurement workshop; Berkeley, CA (United States); 18-20 Nov 1986)			
Summ.	20:24298	*See* SSC-SR–1025			
CONF-9104300–		(Interface 1991: computing science and statistics; Workshop in statistical issues in molecular biology; Joint American Statistical Association (ASA), Institute of Mathematics Statistics and Biometric Society conference; Seattle, WA (United States); Stanford, CA (United States); San Francisco, CA (United States); 22-24 Apr 1991; 8 aug 1993; 8-12 aug 1993)			
Absts.	20:24641	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012915	MF-408
CONF-910505–		(1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC); San Francisco, CA (United States); 6-11 May 1991)			
443	20:24108	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014735	MF-406
444	20:24109	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014736	MF-406
445	20:24110	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014737	MF-406

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CONF-9105208–		(2. annual superconducting super collider (SSCL) conference on electroweak and flavor physics: implications for the SSC; Waxahachie, TX (United States); 20-23 May 1991)			
Vugraphs	20:24779	*See* SSCL-SR–1173			
CONF-9107186–		(2. Brazilian Fair and Congress on Biotechnology; 1. Latin American Fair and Congress on Biotechnology; Sao Paulo (Brazil); 6-10 Jul 1991)			
	20:22999	*See* ETDE-BR–0023			
CONF-9204304–		(Workshop on data acquisition and trigger system simulations for high energy physics; Waxahachie, TX (United States); 23-25 Apr 1992)			
	20:24295	*See* SSCL-SR–1211			
CONF-9205438–		(Italian-French conference Colombo 1992; Genova (Italy); 22 May 1992)			
1	20:23105	*See* ENEA-RT-AMB–92-26			
CONF-9207140–		(Stanford Linear Accelerator Center (SLAC) summer institute on particle accelerators: third family and the physics of flavor; Stanford, CA (United States); 13-24 Jul 1992)			
8	20:24373	*See* SSCL-Preprint–553			
CONF-9209499–		(15. international symposium on nuclear electronics; Warsaw (Poland); 29 Sep - 2 oct 1992)			
	20:24357	*See* JINR-D–13-92-581			
CONF-9210224–		(13. national particle accelerator conference; Dubna (Russian Federation); 13-15 Oct 1992)			
	20:24066	*See* JINR-D–9-92-455			
CONF-9212138–		(Symposium on the fundamental knowledge and application of neutron activation analysis by a reactor; Symposium on the fundamental knowledge and application of neutron activation analysis by a reactor; Symposium on the fundamental knowledge and application o; Kumatori (Japan); Kumatori (Japan); Kumatori (Japan); 21-22 Dec 1992; 9 nov 1993; 15-16 feb 1994)			
	20:23945	*See* KURRI-TR–393			
CONF-930133–		(73. American Meteorological Society (AMS) annual meeting; Anaheim, CA (United States); 17-22 Jan 1993)			
12	20:24452	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008978	MF-412
CONF-9302211–		(Ethics, values and the promise of science: a forum on science and ethics; San Francisco, CA (United States); 25-26 Feb 1993)			
Summ.	20:23674	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011230	MF-400
CONF-930346–		(Optical Society of America meeting on optical remote sensing of the atmosphere; Salt Lake City, UT (United States); 8-12 Mar 1993)			
5	20:24382	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013016	MF-412
CONF-9304293–		(4. international conference on anticarcinogenesis and radiation protection; Baltimore, MD (United States); 18 Apr 1993 - 23 apr 1995)			
	20:24714	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009802	MF-408
CONF-930511–		(PAC '93: international particle accelerator conference; Washington, DC (United States); 17-20 May 1993)			
525	20:24290	*See* SSCL-Preprint–430			
CONF-930537–		(5. annual international industrial symposium on the Super Collider and exhibition; San Francisco, CA (United States); 6-8 May 1993)			
118	20:24287	*See* SSCL-Preprint–212			
119	20:24288	*See* SSCL-Preprint–221			
122	20:24289	*See* SSCL-Preprint–270			
CONF-9306417–		(1. international chromosome 14 workshop; Toronto (Canada); 9-12 Jun 1993)			
Summ.	20:24680	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012828	MF-408

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-930703–		(International cryogenic materials conference (ICMC); Albuquerque, NM (United States); 12-16 Jul 1993)			
47	20:24291	*See* SSCL-Preprint–462			
CONF-9308107–		(Interface 1991: computing science and statistics; Workshop in statistical issues in molecular biology; Joint American Statistical Association (ASA), Institute of Mathematics Statistics and Biometric Society conference; Seattle, WA (United States); Stanford, CA (United States); San Francisco, CA (United States); 22-24 Apr 1991; 8 aug 1993; 8-12 aug 1993)			
Exc.	20:24641	*See* CONF-9104300–Absts.			
CONF-930823–		(15. international symposium on lepton and photon interactions; Ithaca, NY (United States); 10-15 Aug 1993)			
22	20:24778	*See* SSCL-Preprint–552			
CONF-9308268–		(Interface 1991: computing science and statistics; Workshop in statistical issues in molecular biology; Joint American Statistical Association (ASA), Institute of Mathematics Statistics and Biometric Society conference; Seattle, WA (United States); Stanford, CA (United States); San Francisco, CA (United States); 22-24 Apr 1991; 8 aug 1993; 8-12 aug 1993)			
Absts.	20:24641	*See* CONF-9104300–Absts.			
CONF-9308269–		(3. the belt symposium; Whitefish, MT (United States); 14-21 Aug 1993)			
1	20:24753	*See* UCRL-JC–116524			
CONF-9308270–		(9. symposium on accelerator science and technology; Tsukuba (Japan); 25-27 Aug 1993)			
	20:24060	*See* INIS-JP–037			
CONF-9308272–		(Symposium: Treatment of radioactive residues at Hauptabteilung Dekontaminationsbetriebe (HDB) at Kernforschungszentrum Karlsruhe GmbH (KfK); Karlsruhe (Germany); 26 Aug 1993)			
	20:23194	*See* KFK–5351			
CONF-9310435–		(6. Seminar on the gravitational energy and gravitational waves; Dubna (Russian Federation); 26-30 Oct 1993)			
	20:24764	*See* JINR-R–2-94-150			
CONF-9311311–		(Quest for quality communications seminar; Richland, WA (United States); 17 Nov 1993)			
Summ.	20:25029	*See* PNL-SA–23964			
CONF-9311320–		(Workshop on high precision neutron optics; Kumatori (Japan); 10 Nov 1993)			
	20:24369	*See* KURRI-TR–388			
CONF-9311321–		(Symposium on the fundamental knowledge and application of neutron activation analysis by a reactor; Symposium on the fundamental knowledge and application of neutron activation analysis by a reactor; Symposium on the fundamental knowledge and application o; Kumatori (Japan); Kumatori (Japan); Kumatori (Japan); 21-22 Dec 1992; 9 nov 1993; 15-16 feb 1994)			
	20:23945	*See* KURRI-TR–393			
CONF-9402147–		(Symposium on the fundamental knowledge and application of neutron activation analysis by a reactor; Symposium on the fundamental knowledge and application of neutron activation analysis by a reactor; Symposium on the fundamental knowledge and application o; Kumatori (Japan); Kumatori (Japan); Kumatori (Japan); 21-22 Dec 1992; 9 nov 1993; 15-16 feb 1994)			
	20:23945	*See* KURRI-TR–393			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-940301–		(207. spring national meeting of the American Chemical Society (ACS); San Diego, CA (United States); 13-18 Mar 1994)			
47	20:23938	*See* ANL/CHM/CP–85752			
48	20:24950	*See* ANL/CHM/CP–86617			
CONF-9403151–		(Atomic collisions; Oak Ridge, TN (United States); 3-5 Mar 1994)			
3	20:24815	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013205	MF-413; MF-414
CONF-9403173–		(6. colloquium of Fraunhofer-Institut fuer Betriebsfestigkeit (LBF); Darmstadt (Germany); 1-2 Mar 1994)			
	20:23861	*See* LBF-TB–200(1994)			
CONF-9403233–		(Advanced information systems and technology conference; Williamsburg, VA (United States); 28-30 Mar 1994)			
1	20:23997	*See* PNL-SA–24733			
CONF-9404162–		(1994 chemical analysis by laser interrogation of proliferation effluents (CALIOPE ITR) interim technical review; Livermore, CA (United States); 26-28 Apr 1994)			
20	20:24008	*See* UCRL-JC–118151			
21	20:24378	*See* UCRL-JC–118290			
CONF-940423–		(12. European photovoltaic solar energy conference and exhibition; Amsterdam (Netherlands); 11-15 Apr 1994)			
2	20:23466	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016104	MF-1263
CONF-940424–		(8. international conference on radiation shielding; Arlington, TX (United States); 24-27 Apr 1994)			
38	20:24095	*See* SSCL-Preprint–558			
CONF-9404274–		(Forma lacus antiqui conference on geoarchaeology; Bolsena (Italy); 30 Apr 1994)			
1	20:24635	*See* ENEA-RT-AMB–94-18			
CONF-9405202–		(Mesons and nuclei at intermediate energies; Dubna (Russian Federation); 3-7 May 1994)			
	20:24804	*See* JINR-E–4-94-123			
CONF-9405327–		(ICASE/LaRC workshop on parallel numerical algorithms; Norfolk, VA (United States); 23-25 May 1994)			
1	20:24952	*See* ANL/MCS/CP–86036			
CONF-9405328–		(Science and Engineering Research Semester (SERS) student symposium; Livermore, CA (United States); 6 May 1994)			
Absts.	20:23718	*See* UCRL-ID–114972-2			
CONF-940553–		(International high-level radioactive waste management conference; Las Vegas, NV (United States); 22-26 May 1994)			
84	20:24610	*See* SAND–94-0323C			
CONF-940592–		(4. international colloquium on X-ray lasers; Williamsburg, VA (United States); 16-20 May 1994)			
13	20:24835	*See* UCRL-JC–117020			
14	20:24050	*See* UCRL-JC–117006			
CONF-940602–		(35. annual meeting of the American Nuclear Society; New Orleans, LA (United States); 11-16 Jun 1994)			
23-Rev.1	20:24917	*See* UCRL-JC–117397-Rev.1			
CONF-940618–		(4. European particle accelerator conference; London (United Kingdom); 27 Jun - 1 jul 1994)			
121	20:24154	*See* ANL/ASD/CP–83556			
CONF-940623–		(30. joint propulsion conference and exhibit; Indianapolis, IN (United States); 27-29 Jun 1994)			
3	20:24006	*See* UCRL-JC–117482			
CONF-9406323–		(3. annual workshop on industrial ecology; Wood Hole, MA (United States); 25-26 Jun 1994)			
2	20:24624	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012300	MF-402

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9406343–		(59. Cold Spring Harbor Laboratory symposium on quantitative biology: molecular genetics of cancer; Cold Spring Harbor, NY (United States); 1-8 Jun 1994)			
Absts.	20:24642	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016151	MF-408
CONF-940664–		(ISFNT-3: 3rd international symposium on fusion nuclear technology; Los Angeles, CA (United States); 27 Jun - 1 jul 1994)			
36	20:24906	*See* SAND–93-3918C			
CONF-940702–		(1994 Institute of Electrical and Electronic Engineers/Power Engineering Society (IEEE/PES) summer meeting; San Francisco, CA (United States); 24-28 Jul 1994)			
1	20:24032	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013069	MF-906
CONF-9407186–		(State-of-the-art port of entry workshop; Albuquerque, NM (United States); 14-15 Jul 1994)			
Exec.Summ.	20:23769	*See* SAND–95-0867			
CONF-9407190–		(SIAM symposium on control problems in industry; San Diego, CA (United States); 22-23 Jul 1994)			
1	20:24953	*See* ANL/MCS/CP–86446			
CONF-940723–		(Annual meeting of the Society of Photo-Optical Instrumentation Engineers; San Diego, CA (United States); 24-29 Jul 1994)			
43	20:24051	*See* UCRL-JC–118120			
CONF-940738–		(23. DOE/NRC nuclear air cleaning and treatment conference; Buffalo, NY (United States); 25-28 Jul 1994)			
	20:23587	*See* NUREG/CP–0141			
CONF-940748–		(35. annual meeting of the Institute of Nuclear Materials Management (INMM); Naples, FL (United States); 17-20 Jul 1994)			
100	20:23381	*See* BNL–60690			
101	20:23390	*See* PNL-SA–23817			
CONF-9408107–		(American Statistical Association; Toronto (Canada); 14-18 Aug 1994)			
6	20:24405	*See* UCRL-JC–118762			
CONF-940815–		(International nuclear and hazardous waste management conference; Atlanta, GA (United States); 14-18 Aug 1994)			
113	20:23230	*See* PNL-SA–24720			
CONF-9408180–		(4. KINR international school on nuclear physics; Kiev (Ukraine); 29 Aug - 7 sep 1994)			
3	20:24851	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013489	MF-413
CONF-9408213–		(Conference on physics from large gamma-ray detector arrays; Berkeley, CA (United States); 2-6 Aug 1994)			
2	20:24813	*See* UCRL-JC–119301			
CONF-9408239–		(Local alliance building for urban science education (Lab for use); Upton, NY (United States); 7-9 Aug 1994)			
Summ.	20:23673	*See* BNL–61702			
CONF-9408243–		(14. journalists seminar on environmental information: Europe - environmentally friendly without limits?; Frankfurt am Main (Germany); 4 Aug 1994)			
	20:23700	*See* ETDE-DE–176			
CONF-9409167–		(International Union of Theoretical and Applied Mechanics symposium on mechanics problems in geodynamics; Beijing (China); 5-9 Sep 1994)			
1-Rev.1	20:24752	*See* UCRL-JC–116437-Rev.1			
CONF-9409177–		(Optical Society of America conference on extreme ultraviolet lithography; Monterey, CA (United States); 19-21 Sep 1994)			
8	20:24056	*See* UCRL-JC–119629			
9	20:24055	*See* UCRL-JC–119626			
15	20:24396	*See* UCRL-JC–119627			
16	20:24057	*See* UCRL-JC–119634			

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CONF-9409224–		(Biomass pyrolysis oil properties and combustion meeting; Estes Park, CO (United States); 26-28 Sep 1994)			
2	20:23429	*See* PNL-SA–24295			
CONF-9409226–		(ECLIM 23: laser interaction with matter; Oxford (United Kingdom); 19-23 Sep 1994)			
8	20:24922	*See* UCRL-JC–118523			
9	20:24921	*See* UCRL-JC–118517			
CONF-9409242–		(CORINNE 2: international conference on multiparticles correlation and particle production in nucleus-nucleus collisions; Nantes (France); 5-9 Sep 1994)			
3	20:24825	*See* LBL–36370			
CONF-9409352–		(United States/German data exchange agreement (DEA-1522) meeting; No City Given (Germany); 27-30 Sep 1994)			
1	20:24411	*See* UCRL-JC–117608			
2	20:24423	*See* UCRL-JC–117609			
CONF-9409359–		(11. Italian conference on general relativity and gravitational physics; Trieste (Italy); 26-30 Sep 1994)			
1	20:24768	*See* LNF-P–95-010			
CONF-940945–		(5. international conference on hydrogen effects on material behavior; Moran, WY (United States); 11-15 Sep 1994)			
8	20:23868	*See* SAND–95-8502C			
CONF-9410109–		(11. electron beam melting and refining conference - state of the art 1994; Reno, NV (United States); 30 Oct - 1 nov 1994)			
1	20:24007	*See* UCRL-JC–117890			
CONF-941013–		(Applied superconductivity conference; Boston, MA (United States); 16-21 Oct 1994)			
38	20:23894	*See* LA-UR–95-1324			
49	20:24856	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013045	MF-1394
CONF-9410147–		(35. ORNL/DOE analytical chemistry in energy technology conference; Gatlinburg, TN (United States); 6-8 Oct 1994)			
5-Vugraphs	20:24442	*See* ANL/CMT-ACL/VU–83596			
CONF-9410155–		(26. annual symposium on optical materials for high power lasers: Boulder damage symposium; Boulder, CO (United States); 24-26 Oct 1994)			
4	20:23932	*See* UCRL-JC–118164			
7	20:24923	*See* UCRL-JC–118837			
5-Pt.1	20:24919	*See* UCRL-JC–118156-Pt.1			
6-Pt.2	20:24920	*See* UCRL-JC–118156-Pt.2			
CONF-941016–		(Materials week '94; Rosemont, IL (United States); 3-7 Oct 1994)			
7	20:23837	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013223	MF-114
CONF-9410190–		(18. annual training resources and data exchange conference: meeting line management expectations; Dallas, TX (United States); 31 Oct - 2 nov 1994)			
Absts.	20:24931	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010551	MF-600; MF-900; MF-700; MF-2000
CONF-9410219–		(Beam instrumentation workshop; Vancouver (Canada); 2-6 Oct 1994)			
25	20:24143	*See* SLAC-PUB–95-6684			
CONF-9410244–		(3. international symposium on structural and functional gradient materials; Lausanne (Switzerland); 10-12 Oct 1994)			
2	20:23903	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013225	MF-1425
CONF-9410280–		(International workshop on radiation damage in DNA: relationships at early times; Gleneden, OR (United States); 1-6 Oct 1994)			
2	20:24727	*See* PNL-SA–26269			

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CONF-9410309–		(Contractor's coordination meeting; Dearborn, MI (United States); 24-27 Oct 1994)			
5	20:23817	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013355	MF-1505
CONF-9410317–		(IHEP: 1994 Beijing calorimetry symposium; Beijing (China); 25-27 Oct 1994)			
4	20:24379	*See* UCRL-JC–119320			
CONF-9410337–		(Scalable parallel libraries conference; Starksville, MS (United States); 12-14 Oct 1994)			
1	20:24977	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010291	MF-405
CONF-9410349–		(38. conference on chemical research, chemical dynamics of transient species; Houston, TX (United States); 24-25 Oct 1994)			
2	20:23962	*See* LBL–36465			
CONF-9410353–		(2. sharing our successes conference on changing the face of science and mathematics education through teacher-focused partnerships; Berkeley, CA (United States); 12-14 Oct 1994)			
Exc.	20:23675	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014714	MF-400
CONF-9410357–		(Iowa's pursuit of energy efficiency conference; Des Moines, IA (United States); 25-26 Oct 1994)			
1	20:23430	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013985	MF-1310
CONF-941101–		(Meeting of the Division of Plasma Physics of the American Physical Society; Minneapolis, MN (United States); 7-11 Nov 1994)			
11	20:24142	*See* SAND–94-1911			
12	20:24918	*See* UCRL-JC–118104			
CONF-941102–		(Winter meeting of the American Nuclear Society; Washington, DC (United States); 13-18 Nov 1994)			
45	20:23167	*See* ANL/EA/CP–84766			
CONF-9411152–		(International Atomic Energy Agency (IAEA) technical committee meeting on drivers for inertial confinement fusion; Paris (France); 14-18 Nov 1994)			
5	20:24915	*See* UCRL-JC–117332			
6	20:24914	*See* UCRL-JC–117302			
CONF-9411155–		(1994 Luxembourg international symposium on the rehabilitation of military sites and demilitarization of explosive ordance; Kirchberg (Luxembourg); 14-18 Nov 1994)			
4-Rev.1	20:24422	*See* UCRL-JC–117608-Rev.1			
5-Rev.1	20:24424	*See* UCRL-JC–117609-Rev.1			
CONF-941118–		(Supercomputing '94 meeting; Washington, DC (United States); 14-18 Nov 1994)			
11	20:25003	*See* PNL-SA–24715			
CONF-9411185–		(NEANC specialist's meeting on measurement, calculation, and evaluation of photon production data; Bologna (Italy); 9-11 Nov 1994)			
5	20:24816	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014264	MF-413; MF-405
CONF-9411234–		(Applications of synchrotron radiation techniques to materials science; Boston, MA (United States); 28 Nov - 2 dec 1994)			
1	20:23835	*See* ANL/XFD/CP–83323			
CONF-9411236–		(Advanced turbine systems (ATS) annual review meeting; Washington, DC (United States); 8-11 Nov 1994)			
1	20:23885	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013979	MF-1406
CONF-941124–		(33. Hanford symposium on health and the environment: symposium on in-situ remediation–scientific basis for current and future technologies; Richland, WA (United States); 7-11 Nov 1994)			
23	20:23366	*See* PNL-SA–24280			

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CONF-941138–		(International specialty conference: the emission inventory - applications and improvements; Raleigh, NC (United States); 1-3 Nov 1994)			
1	20:24551	*See* UCRL-JC–118633			
CONF-941144–		(1994 fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 28 Nov - 2 dec 1994)			
150	20:23834	*See* ANL/MSD/CP–83449			
153	20:23870	*See* SAND–95-8525C			
155	20:23883	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008972	MF-404
159	20:23838	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013226	MF-404
160	20:23935	*See* UCRL-JC–119216			
161	20:23897	*See* UCRL-JC–120259			
164	20:23884	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013988	MF-404
165	20:24916	*See* UCRL-JC–117389			
CONF-941174–		(Meeting of the Fluid Dynamics Division of the American Physical Society; Atlanta, GA (United States); 20-22 Nov 1994)			
1	20:24850	*See* UCRL-JC–115959			
CONF-941182–		(6. international Toki conference on plasma physics and controlled nuclear fusion: Research for advanced concepts in magnetic fusion; Toki-city (Japan); 29 Nov - 2 dec 1994)			
4	20:24883	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013044	MF-420
CONF-941192–		(Symposium on radioactive and mixed waste: risk as a basis for waste classification; Las Vegas, NV (United States); 9 Nov 1994)			
	20:23215	*See* NCRP–95-22246			
CONF-941203–		(1. world conference on photovoltaic energy conversion; Waikoloa, HI (United States); 5-9 Dec 1994)			
25	20:23479	*See* UCRL-JC–118267			
28	20:23467	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016102	MF-1263
CONF-941207–		(Spent nuclear fuel meeting: challenges and initiatives; Salt Lake City, UT (United States); 14-16 Dec 1994)			
37	20:23148	*See* ANL/ET/CP–83253			
CONF-941227–		(5. symposium on current issues related to nuclear power plant structure, equipment and piping; Orlando, FL (United States); 14-16 Dec 1994)			
5	20:23371	*See* UCRL-JC–119038			
CONF-941255–		(Life cycles of energetic materials; Del Mar, CA (United States); 11-16 Dec 1994)			
4	20:24425	*See* UCRL-JC–119654			
CONF-941274–		(Emerging roles of energy storage in a competitive power market; Pleasanton, CA (United States); 6-7 Dec 1994)			
Summ.	20:23664	*See* SAND–95-8247			
CONF-950101–		(Advanced solid-state laser conference; Memphis, TN (United States); 29 Jan - 1 feb 1995)			
5	20:23933	*See* UCRL-JC–118192			
5	20:24394	*See* UCRL-JC–118195			
CONF-9501100–		(Mixed waste focus area alternative technologies workshop; Salt Lake City, UT (United States); 24-27 Jan 1995)			
Summ	20:23211	*See* LA-UR–95-1838			
CONF-950112–		(9. joint workshop on electron cyclotron emission and electron cyclotron resonance heating; Borrego Springs, CA (United States); 23-26 Jan 1995)			
3	20:24881	*See* UCRL-JC–119843			
CONF-950117–		(Workshop on semiconductor characterization; Gaithersburg, MD (United States); 30 Jan - 2 feb 1995)			
5	20:24852	*See* SAND–94-2468C			
CONF-950129–		(19. annual conference on advanced ceramics, materials and structures; Cocoa Beach, FL (United States); 9-12 Jan 1995)			
10	20:23880	*See* ANL/ET/CP–85328			

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CONF-950159–		(Workshop and symposium on geostatistics for geotechnical and environmental applications; Phoenix, AZ (United States); 26-27 Jan 1995)			
2	20:24559	*See* ANL/EA/CP–85472			
CONF-950183–		(Recontres de Moriond workshop; Villar-sur-Ollon (Switzerland); 21-28 Jan 1995)			
3	20:23951	*See* BNL–61802			
CONF-950193–		(74. annual transportation research board meeting; Washington, DC (United States); 11-15 Jan 1995)			
1	20:24449	*See* ANL/ES/CP–83898			
2	20:23764	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014286	
CONF-950198–		(Physics with the collider detectors at Relavitistic Heavy Ion Collider (RHIC) and the LHC; Livermore, CA (United States); 8 Jan 1995)			
	20:24377	*See* UCRL-ID–121571			
CONF-950201–		(Annual meeting and exhibition of the Minerals, Metals and Materials Society (TMS); Las Vegas, NV (United States); 12-16 Feb 1995)			
17	20:23831	*See* ANL/ES/CP–84366			
19	20:23839	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014993	MF-700
CONF-950209–		(4. international symposium on field screening methods for hazardous wastes and toxic chemicals; Las Vegas, NV (United States); 22-24 Feb 1995)			
8	20:24564	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008969	MF-2070
10	20:24347	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013356	MF-2070
CONF-9502105–		(International workshop on computer simulation in condensed matter physics; Athens, GA (United States); 20-24 Feb 1995)			
1	20:23902	*See* ANL/MSD/CP–86064			
CONF-9502108–		(1995 annual Metallurgical Society meeting; Las Vegas, NV (United States); 12-16 Feb 1995)			
1	20:23947	*See* UCRL-JC–119349			
CONF-9502109–		(International symposium on gamma titanium aluminides (ISGTA-95); Las Vegas, NV (United States); 12 Feb - 16 mar 1995)			
1	20:23840	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014268	MF-404
CONF-950216–		(Waste management '95; Tucson, AZ (United States); 26 Feb - 2 mar 1995)			
149	20:23798	*See* UCRL-JC–119975			
150	20:23231	*See* PNL-SA–24982			
151	20:23372	*See* WHC-SA–2623			
152	20:24615	*See* WSRC-MS–94-0528			
153	20:23232	*See* PNL-SA–25753			
154	20:23233	*See* PNL-SA–25764			
CONF-950225–		(Geoenvironment 2000 meeting; Baton Rouge, LA (United States); 22-24 Feb 1995)			
2	20:23169	*See* ANL/EWM/CP–82616			
CONF-950226–		(SPIE '95: SPIE conference on optics, electro-optics, and laser application in science, engineering and medicine; San Jose, CA (United States); 5-14 Feb 1995)			
46	20:24528	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008971	MF-401; MF-402; MF-406
51	20:24707	*See* UCRL-JC–120177			
52	20:24011	*See* UCRL-JC–120009			
53	20:24053	*See* UCRL-JC–119257			
54	20:24054	*See* UCRL-JC–119611			
55	20:24052	*See* UCRL-JC–118186			
CONF-950232–		(6. American Nuclear Society meeting on robotics and remote systems; Monterey, CA (United States); 5-10 Feb 1995)			
34	20:23577	*See* ANL/RA/CP–82800			
36	20:24407	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014288	
37	20:23975	*See* ANL/ET/CP–82671			

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CONF-950244–		(5. IEEE working conference on current measurement: upper ocean, boundary layer, moving platform, and non-invasive current measurements; St. Petersburg, FL (United States); 7-9 Feb 1995)			
1	20:24010	*See* UCRL-JC–119080			
CONF-950245–		(5. international conference on the science of hard materials; Maui, HI (United States); 20-24 Feb 1995)			
3	20:23904	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013352	MF-1425
CONF-950265–		(Harold A. Oeye international symposium; Trondheim (Norway); 2-3 Feb 1995)			
2	20:23950	*See* ANL/CMT/CP–84826			
CONF-950285–		(LAFEX international school in high energy physics; Rio de Janeiro (Brazil); 20 Feb 1995)			
4	20:24780	*See* FNAL/C–95/117			
CONF-950293–		(Nuclear and particle physics conference; Seoul (Korea, Republic of); 6-10 Feb 1995)			
1	20:24785	*See* LA-UR–95-1489			
CONF-950298–		(International workshop on advanced batteries; Osaka (Japan); 22-24 Feb 1995)			
1	20:23811	*See* ANL/CMT/CP–85327			
CONF-950304–		(Corrosion '95: National Association of Corrosion Engineers (NACE) international annual conference and corrosion show; Orlando, FL (United States); 26-31 Mar 1995)			
15	20:23836	*See* BNL–61673			
CONF-950309–		(25. annual conference and exhibition on wind power; Washington, DC (United States); 26-30 Mar 1995)			
8	20:23507	*See* NREL/TP–441-7808			
CONF-9503104–		(9. symposium on meteorological observations and instrumentation; Charlotte, NC (United States); 27-31 Mar 1995)			
4	20:24446	*See* ANL/ER/CP–85219			
5	20:24445	*See* ANL/ER/CP–84198			
CONF-950311–		(International conference on fuel management and handling; Edinburgh (United Kingdom); 20-22 Mar 1995)			
5	20:23555	*See* ANL/IFR/CP–82835			
6	20:23556	*See* ANL/IFR/CP–82925			
7	20:23554	*See* ANL/FE/CP–85555			
CONF-9503114–		(3. national new construction programs for demand side management conference; Boston, MA (United States); 26-29 Mar 1995)			
2	20:23703	*See* PNL-SA–25942			
CONF-9503116–		(1995 TOUGH workshop; Berkeley, CA (United States); 20-22 Mar 1995)			
11	20:24611	*See* SAND–95-1084C			
CONF-950313–		(20. international technical conference on coal utilization and fuels systems; Clearwater, FL (United States); 20-23 Mar 1995)			
2	20:23518	*See* DOE/MC/31327–95/C0451			
CONF-9503135–		(APIC '95; El Paso, TX (United States); Mar 1995)			
9	20:24998	*See* LA-UR–95-1223			
CONF-9503140–		(5. atmospheric radiation measurement (ARM) meeting; San Diego, CA (United States); 20-23 Mar 1995)			
4	20:24447	*See* ANL/ER/CP–86001			
8	20:24448	*See* ANL/ER/CP–86626			
9	20:24549	*See* PNL-SA–25949			
CONF-9503144–		(7. international symposium on integrated ferroelectrics; Colorado Springs, CO (United States); 20-22 Mar 1995)			
2	20:23905	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014270	MF-404
CONF-9503147–		(Rencontres de Physique de la Valle' d'Aoste; La Thuile (Italy); Mar 1995)			
3	20:24790	*See* FNAL/C–95/103-E			
4	20:24789	*See* FNAL/C–95/096-E			

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CONF-9503149–		(2. chemical analysis by laser interrogation of proliferation effluents (CALIOPE) meeting; Albuquerque, NM (United States); 28-30 Mar 1995)			
5	20:24390	*See* PNL-SA–26254			
CONF-9503154–		(Remote sensing and environmental monitoring for the sustainable development of the Americas; San Juan (Puerto Rico); 21-22 Mar 1995)			
1	20:24560	*See* ANL/EA/CP–86344			
CONF-9503158–		(30. Rencontres de Moriond on QCD and high energy interactions; Les Arcs (France); 19-26 Mar 1995)			
3	20:24783	*See* FNAL/C–95/115-E			
7	20:24788	*See* FNAL/C–95/046-E			
10	20:24791	*See* FNAL/C–95/109-E			
13	20:24792	*See* FNAL/C–95/144			
14	20:24793	*See* FNAL/C–95/150-E			
15	20:24794	*See* FNAL/C–95/161-E			
CONF-9503164–		(6. annual tank automotives command (TACOM) combat vehicle survivability symposium; Monterey, CA (United States); 28-30 Mar 1995)			
3	20:24408	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013972	
CONF-9503166–		(Fluor Daniel at Lawrence Livermore National Laboratory; Livermore, CA (United States); 29 Mar 1995)			
1	20:23403	*See* UCRL-JC–120593			
CONF-9503167–		(1995 International Astronomical Union (IAU) colloquium #152 on astrophysics in the extreme ultraviolet; Berkeley, CA (United States); 27-30 Mar 1995)			
1	20:24772	*See* UCRL-JC–120862			
CONF-9503168–		(10. American Institute of Aeronautics and Astronautics (AIAA) conference on computing and aerospae; San Antonio, TX (United States); 28-30 Mar 1995)			
1	20:24409	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013970	
CONF-950333–		(2. SPE/EPA exploration and production environmental conference: government and industry working together to find cost effective approaches to protecting the environment; Houston, TX (United States); 27-29 Mar 1995)			
1	20:23095	*See* LA-UR–95-741			
3	20:23068	*See* ANL/EA/CP–83975			
CONF-950336–		(American Society of Mechanical Engineers/Japanese Society of Mechanical Engineers/Japan Solar Energy Society international solar energy conference; Lahaina, HI (United States); 19-24 Mar 1995)			
28	20:24757	*See* ANL/ET/CP–82236			
CONF-950380–		(Annual meeting of the Division of High Polymer Physics of the American Physical Society; San Jose, CA (United States); 20-24 Mar 1995)			
2	20:23851	*See* DOE/ER–45529			
CONF-950388–		(13. geothermal program review; San Francisco, CA (United States); 13-16 Mar 1995)			
2	20:23498	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013351	MF-254; MF-401
CONF-950401–		(97. annual meeting of the American Ceramic Society; Cincinnati, OH (United States); 30 Apr - 1 may 1995)			
6	20:23900	*See* ANL/CMT/CP–84719			
7	20:23901	*See* ANL/CMT/CP–84722			
10	20:23164	*See* ANL/CMT/CP–84717			
11	20:23358	*See* FEMP–2388			
12	20:23927	*See* SAND–95-1290C			
13	20:23160	*See* ANL/CMT/CP–84524			
14	20:24391	*See* SAND–95-1306C			
15	20:23161	*See* ANL/CMT/CP–84526			

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16	20:23162	*See* ANL/CMT/CP–84590			
17	20:23895	*See* PNL-SA–26298			
18	20:23234	*See* PNL-SA–26071			
19	20:23886	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014274	
20	20:23163	*See* ANL/CMT/CP–84591			
CONF-9504119–		(AWMA international speciality conference on thermal treatment and waste-to-energy technologies for solid waste management; Washington, DC (United States); 18-21 Apr 1995)			
1	20:23236	*See* PNL-SA–26147			
CONF-950412–		(Spring meeting of the Materials Research Society (MRS); San Francisco, CA (United States); 17-21 Apr 1995)			
15	20:24013	*See* UCRL–JC-120672			
16	20:23906	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013211	MF-404
20	20:23934	*See* UCRL-JC–118841			
21	20:23907	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013987	MF-404
22	20:23841	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013986	MF-404
23	20:23842	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014199	MF-404
CONF-9504123–		(Innovative concepts technology and business opportunities; Denver, CO (United States); 20-21 Apr 1995)			
1	20:23775	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013041	MF-420
2	20:23316	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014598	MF-2020
CONF-950414–		(57. annual American power conference; Chicago, IL (United States); 18-20 Apr 1995)			
5	20:23726	*See* ANL/DIS/CP–85733			
7	20:23658	*See* PNL-SA–25889			
CONF-9504160–		(1995 DOE/NREL hydrogen program review; Coral Gables, FL (United States); 18-21 Apr 1995)			
1	20:23415	*See* LA-UR–95-1466			
4	20:23824	*See* UCRL-JC–120152			
5	20:23819	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014271	MF-1504
CONF-9504161–		(Central States/Western States Institute and American Flame Research committee meeting; San Antonio, TX (United States); 23-26 Apr 1995)			
1	20:23810	*See* SAND–95-8562C			
2	20:24030	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013209	MF-104; MF-113
CONF-9504169–		(4. international workshop on postionization techniques in surface analysis (PITSA); Burgenland (Austria); 23-27 Apr 1995)			
1	20:24854	*See* ANL/CHM/CP–86330			
CONF-9504170–		(Weaving the astronomy web conference; Strasbourg (France); 6-7 Apr 1995)			
1	20:24754	*See* FNAL/C–95/064			
CONF-9504174–		(American Society of Mechanical Engineers (ASME) 1995 Spring technical conference; Marietta, OH (United States); 23-26 Apr 1995)			
1	20:23809	*See* ANL/ES/CP–85485			
CONF-9504176–		(Surface science '95 symposium; Kizsteinhorn/Kaprun (Austria); 23-29 Apr 1995)			
1	20:23843	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013992	MF-404
CONF-9504177–		(The new Panama Canal: another path between the seas; New York, NY (United States); 27 Apr 1995)			
1	20:23765	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013993	MF-400
CONF-9504178–		(1995 tropical and ocean global atmosphere (TOGA) conference; Melbourne (Australia); 2-7 Apr 1995)			
1	20:24555	*See* UCRL-JC–121009			
CONF-9504179–		(6. annual international conference on high level radioactive waste management; Las Vegas, NV (United States); 30 Apr - 5 may 1995)			
1	20:23212	*See* LBL–37040			

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2	20:23331	*See* PNL-SA–26209			
3	20:23250	*See* UCRL-JC–120957			
CONF-9504181–		(International conference on shaping of advanced ceramics; Mol (Belgium); 25-27 Apr 1995)			
1	20:23887	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014267	MF-1505; MF-1406
CONF-9504182–		(78. steelmaking and 54. ironmaking conference; Nashville, TN (United States); 2-5 Apr 1995)			
1	20:23774	*See* ANL/ET/CP–85947			
CONF-9504185–		(Software technology conference; Salt Lake City, UT (United States); 9-14 Apr 1995)			
1	20:25006	*See* PNL-SA–26072			
CONF-9504186–		(ORACLE/DOE special interest group meeting on emergency management system; Richland, WA (United States); 19-21 Apr 1995)			
1	20:23705	*See* PNL-SA–26129			
CONF-950420–		(International conference on mathematics and computations, reactor physics, and environmental analyses; Portland, OR (United States); 30 Apr - 4 may 1995)			
25	20:23612	*See* ANL/IFR/CP–85456			
27	20:24609	*See* PNL-SA–25679			
CONF-950426–		(3. international conference on nuclear engineering; Kyoto (Japan); 23-27 Apr 1995)			
5	20:23611	*See* ANL/ET/CP–83008			
CONF-950429–		(7. biennial workshop on organometallic vapor phase epitaxy; Fort Meyers, FL (United States); 2-6 Apr 1995)			
1	20:23866	*See* SAND–95-0841C			
CONF-950430–		(5. ANS topical meeting on emergency preparedness and response; Savannah, GA (United States); 18-21 Apr 1995)			
6	20:24715	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013876	MF-2000
7	20:24548	*See* PNL-SA–25632			
8	20:24444	*See* ANL/EA/CP–84904			
9	20:23336	*See* ANL/DIS/CP–84269			
CONF-950431–		(High performance computing '95; Tucson, AZ (United States); 9-13 Apr 1995)			
3	20:24954	*See* ANL/MCS/CP–86648			
CONF-950439–		(SMS simulation multiconference: simulation as a critical technology; Phoenix, AZ (United States); 9-13 Apr 1995)			
13	20:23763	*See* ANL/RA/CP–85716			
15	20:24406	*See* ANL/DIS/CP–85699			
CONF-950450–		(8. annual symposium on the application of geophysics to environmental and engineering problems; Orlando, FL (United States); 23-27 Apr 1995)			
10	20:24565	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013050	MF-402
11	20:23109	*See* ANL/ES/CP–85486			
CONF-950451–		(21. national environmental symposium and exhibition; San Diego, CA (United States); 17-21 Apr 1995)			
2	20:24558	*See* ANL/EA/CP–84325			
5	20:25004	*See* PNL-SA–24972			
CONF-950454–		(22. international AVS conference on metallurgical coatings and thin films; San Diego, CA (United States); 24-28 Apr 1995)			
4	20:24853	*See* ANL/CHM/CP–84380			
CONF-950472–		(SPIE international symposium on aerospace/defense sensing and dual-use photonics; Orlando, FL (United States); 17-21 Apr 1995)			
8	20:23799	*See* UCRL-JC–120745			
9	20:24439	*See* UCRL-JC–120867			
10	20:24438	*See* UCRL-JC–120866			
11	20:24437	*See* UCRL-JC–120858			

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12	20:24395	*See* UCRL-JC–119165			
13	20:24381	*See* BNL–61332-(Rev.4/95)			
14	20:24440	*See* UCRL-JC–120870			
15	20:24436	*See* UCRL-JC–120857			
CONF-950476–		(12. international conference on laser interaction and related plasma phenomena; Osaka (Japan); 24-28 Apr 1995)			
5	20:24902	*See* LA-UR–95-1439			
CONF-950483–		(3. international symposium on in situ and on-site bioreclamation; San Diego, CA (United States); 24-27 Apr 1995)			
3	20:24607	*See* PNL-SA–25640			
4	20:24705	*See* PNL-SA–26258			
5	20:24608	*See* PNL-SA–25678			
CONF-950494–		(Natural gas research, development and demonstration contractors review meeting; Baton Rouge, LA (United States); 4-6 Apr 1995)			
11	20:23119	*See* DOE/MC/31162–95/C0465			
15	20:23113	*See* DOE/MC–25031-95/C0453			
19	20:23114	*See* DOE/MC/26025–95/C0475			
22	20:23111	*See* DOE/MC–85000-95/C0477			
24	20:23116	*See* DOE/MC/28133–95/C0485			
25	20:23123	*See* DOE/MC/27346–95/C0480			
26	20:23118	*See* DOE/MC/29077–95/C0490			
27	20:23115	*See* DOE/MC/26026–95/C0482			
28	20:23108	*See* DOE/METC/C–95/7191			
29	20:23122	*See* DOE/MC/13223–95/C0484			
30	20:23126	*See* DOE/MC/31112–95/C0488			
31	20:23434	*See* DOE/MC/60249–95/C0486			
32	20:23117	*See* DOE/MC/28182–95/C0489			
CONF-9505100–		(4. European workshop on modern developments and applications in microbeam analysis: microbeam and nanobeam techniques; Saint-Malo (France); 14-18 May 1995)			
1	20:24026	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013040	MF-404; MF-406
CONF-9505101–		(Conference on challenges and innovations in the management of hazardous waste; Washington, DC (United States); 10-12 May 1995)			
1	20:23941	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013204	MF-2030
2	20:23315	*See* ANL/DIS/CP–85160			
5	20:23174	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013984	MF-2030
6	20:23175	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014200	MF-2000
7	20:23338	*See* ANL/ES/CP–86536			
CONF-9505105–		(11. topical conference on radio frequency in plasmas; Palm Springs, CA (United States); 17-19 May 1995)			
1	20:24865	*See* GA-A–22062			
3	20:24864	*See* GA-A–22048			
5	20:24859	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014592	MF-421
CONF-9505115–		(ASCE engineering mechanics conference; Boulder, CO (United States); 21-24 May 1995)			
4	20:23924	*See* SAND–95-0833C			
CONF-950512–		(Particle accelerator conference; Dallas, TX (United States); 1-5 May 1995)			
128	20:24063	*See* BNL–61222			
130	20:24284	*See* SLAC-PUB–95-6908			
131	20:24283	*See* SLAC-PUB–95-6907			
132	20:24282	*See* SLAC-PUB–95-6906			
134	20:24280	*See* SLAC-PUB–95-6879			
139	20:24300	*See* BNL–61191			
141	20:24180	*See* BNL–61777			
144	20:24759	*See* LA-UR–95-1539			
146	20:24131	*See* LA-UR–95-1567			
150	20:24130	*See* LA-UR–95-1549			
153	20:24132	*See* LA-UR–95-1568			
163	20:24181	*See* BNL–61850			

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166	20:24301	*See* BNL--61848			
168	20:24337	*See* SLAC-PUB--95-6901			
169	20:24101	*See* ANL/ASD/CP--85016			
171	20:24156	*See* ANL/ASD/CP--84924			
172	20:24176	*See* ANL/XFD/CP--85084			
173	20:24338	*See* SLAC-PUB--95-6902			
174	20:24336	*See* SLAC-PUB--95-6897			
177	20:24147	*See* SLAC-PUB--95-6840			
178	20:24341	*See* UCRL-JC--120158			
179	20:24092	*See* SLAC-PUB--95-6825			
182	20:24171	*See* ANL-HEP-CP--95-35			
184	20:24145	*See* SLAC-PUB--95-6802			
188	20:24335	*See* SLAC-PUB--95-6812			
195	20:24144	*See* SLAC-PUB--95-6791			
198	20:24299	*See* ANL/APS/CP--84921			
204	20:24106	*See* ANL/PHY/CP--85476			
206	20:24160	*See* ANL/ASD/CP--84991			
213	20:24340	*See* UCRL-JC--119408			
214	20:24107	*See* BNL--61495			
217	20:24302	*See* BNL--61853			
219	20:24103	*See* ANL/ASD/CP--85046			
220	20:24169	*See* ANL/ASD/CP--85065			
223	20:24146	*See* SLAC-PUB--95-6806			
224	20:24153	*See* UCRL-JC--119186			
227	20:24167	*See* ANL/ASD/CP--85056			
228	20:24104	*See* ANL/ASD/CP--85055			
229	20:24166	*See* ANL/ASD/CP--85051			
230	20:24165	*See* ANL/ASD/CP--85048			
231	20:24162	*See* ANL/ASD/CP--85007			
232	20:24102	*See* ANL/ASD/CP--85017			
233	20:24061	*See* ANL/ASD/CP--85045			
234	20:24164	*See* ANL/ASD/CP--85010			
235	20:24163	*See* ANL/ASD/CP--85009			
236	20:24173	*See* ANL/PHY/CP--85355			
237	20:24235	*See* LA-UR--95-1385			
238	20:24236	*See* LA-UR--95-1386			
239	20:24170	*See* ANL/ASD/CP--85097			
240	20:24105	*See* ANL/PHY/CP--85352			
241	20:24172	*See* ANL/PHY/CP--85353			
242	20:24168	*See* ANL/ASD/CP--85063			
243	20:24177	*See* ANL/XFD/CP--86468			
244	20:24175	*See* ANL/TD/CP--85060			
245	20:24161	*See* ANL/ASD/CP--84996			
247	20:24157	*See* ANL/ASD/CP--84987			
248	20:24159	*See* ANL/ASD/CP--84990			
249	20:24339	*See* UCRL-JC--119407			
250	20:24174	*See* ANL/PHY/CP--86550			
251	20:24158	*See* ANL/ASD/CP--84989			
252	20:24281	*See* SLAC-PUB--95-6894			
258	20:24155	*See* ANL/ASD/CP--84923			
260	20:24237	*See* LBL--36459			
261	20:24800	*See* LBL--36499			
262	20:24111	*See* FNAL/C--95/171			
282	20:24903	*See* LBL--36487			
284	20:24090	*See* LBL--36565			
CONF-9505122--		(International conference on ion beam analysis; Tempe, AZ (United States); 22-26 May 1995)			
1	20:24046	*See* SAND--95-1425C			
2	20:23896	*See* PNL-SA--26451			
CONF-9505131--		(International symposium on the extraction and applications of zinc and lead; Sendai (Japan); 22-24 May 1995)			
1	20:23773	*See* ANL/ES/CP--82597			
CONF-9505155--		(9. international heat pipe conference; Albuquerque, NM (United States); 1-5 May 1995)			
3	20:23998	*See* PNL-SA--25597			
CONF-950518--		(187. meeting of the Electrochemical Society; Reno, NV (United States); 21-26 May 1995)			
6	20:23923	*See* SAND--94-3244C			
7	20:23877	*See* UCRL-JC--119687			
12	20:23898	*See* ANL/CHM/CP--86590			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
14	20:23928	*See* SAND–95-1291C			
CONF-9505186–		(2. physical phenomena at high magnetic fields conference; Tallahassee, FL (United States); 6-9 May 1995)			
3	20:24855	*See* ANL/MSD/CP–82694			
CONF-9505192–		(4. international symposium on diamond materials; Reno, NV (United States); 21-26 May 1995)			
3	20:23936	*See* UCRL-JC–119571			
CONF-9505193–		(1995 international conference on robotics and automation; Nagoya (Japan); 21-27 May 1995)			
5	20:23999	*See* PNL-SA–26161			
CONF-9505195–		(Nuclear criticality technology and safety project (NCTSP) annual meeting; San Diego, CA (United States); 17 May 1995)			
8	20:23564	*See* ANL/RA/CP–86533			
CONF-9505198–		(REXX symposium for developers and users; Stanford, CA (United States); 1-3 May 1995)			
	20:25009	*See* SLAC-R–95-464			
CONF-9505204–		(9, annual conference on fossil energy materials; Oak Ridge, TN (United States); 16-18 May 1995)			
2	20:23832	*See* ANL/ET/CP–86147			
4	20:23881	*See* ANL/ET/CP–86059			
5	20:23844	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014280	MF-104
CONF-9505207–		(Regional seminar on the national implementation of the chemical weapons convention; Yamoussoukro (South Africa); 9 May 1995)			
3	20:23825	*See* ANL/DIS/CP–86453			
CONF-9505208–		(Pacific basin conference on hazardous waste; Alberta (Canada); 7-12 May 1995)			
2	20:23687	*See* ANL/EA/CP–83912			
CONF-9505217–		(Air & Waste Management Association Policy meeting; Washington, DC (United States); 10-12 May 1995)			
1	20:23249	*See* UCRL-JC–120933			
2	20:23176	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013201	MF-402
3	20:23337	*See* ANL/ES/CP–85247			
CONF-9505221–		(Dual-use technologies and applications conference; Utica, NY (United States); 22-25 May 1995)			
1	20:24924	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013202	MF-405
CONF-9505224–		(International Emergency Management and Engineering Society; Nice (France); 9-12 May 1995)			
1	20:24441	*See* ANL/DIS/CP–84688			
CONF-9505225–		(8. semiannual environmental, safety, and health coordination meeting; Gaithersburg, MD (United States); 23-25 May 1995)			
Summ.	20:23168	*See* ANL/EQO/VU–86239			
CONF-9505226–		(4. space electrochemical research and technology conference; Cleveland, OH (United States); 2-3 May 1995)			
1	20:23745	*See* ANL/CMT/CP–85790			
CONF-9505227–		(17. ERSADA symposium on safeguards and nuclear material management; Aachen (Germany); 9-11 May 1995)			
1	20:23543	*See* ANL/TD/CP–85179			
CONF-9505228–		(48. Society for Imaging Science and Technology (IS&T) annual conference; Washington, DC (United States); 7-12 May 1995)			
1	20:23971	*See* ANL/CHM/CP–85693			
CONF-9505232–		(5. Mediterranean symposium on nuclear medicine and radiopharmaceuticals - receptors; Athens (Greece); 23-28 May 1995)			
1	20:24698	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012870	MF-408; MF-600
2	20:24699	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014289	MF-408

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9505234--		(2. international symposium on computerized chemical data standards: databases, data interchange, and information systems; Columbus, OH (United States); 10-12 May 1995)			
1	20:25021	*See* ANL/OTD-PR/CP-86451			
CONF-9505235--		(Industrial Engineering Research conference; Nashville, TN (United States); 25-26 May 1995)			
1	20:23986	*See* KCP-613-5570			
CONF-9505236--		(Sybase Users Group conference; Dallas, TX (United States); 15-18 May 1995)			
1	20:23235	*See* PNL-SA-26111			
CONF-9505237--		(High Temperture Superconductor (HTS) workshop on applications and new materials; Enschede (Netherlands); 8-10 May 1995)			
1	20:23888	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014272	MF-404
CONF-9505238--		(NATO international scientific exchange program advanced research workshop; St. Petersburg (Russian Federation); 14-17 May 1995)			
1	20:23252	*See* UCRL-JC-120995			
CONF-9505240--		(Pacific NW fiber optic sensor conference: Troutdale, OR (United States); 3-4 May 1995)			
1	20:24372	*See* PNL-SA-26104			
2	20:24389	*See* PNL-SA-26103			
CONF-9505241--		(1995 precision cleaning conference; Rosemont, IL (United States); 15-17 May 1995)			
1	20:23797	*See* PNL-SA-25944			
CONF-9505242--		(1995 ESRI user conference; Palm Springs, CA (United States); 22-26 May 1995)			
1	20:25007	*See* PNL-SA-26086			
CONF-9505248--		(LeCroy conference on electronics for particle physics; Chestnut Ridge, NY (United States); May 1995)			
1	20:24187	*See* FNAL/C-95/170			
CONF-950534--		(Conference on real-time computer applications in nuclear, particle and plasma physics (RT); East Lansing, MI (United States); 22-26 May 1995)			
3	20:24185	*See* FNAL/C-95/118			
4	20:24978	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014596	MF-400
CONF-950542--		(14. international symposium on thermal treatment technologies: incineration conference; Seattle, WA (United States); 8-12 May 1995)			
1	20:24951	*See* ANL/EA/CP-86212			
CONF-950561--		(1. world conference on environmental catalysis for a better world and life: 529th event of the European Federation of Chemical Engineering; Pisa (Italy); 1-5 May 1995)			
1	20:23964	*See* PNL-SA-24794			
CONF-950564--		(9. symposium on power plant dynamics, control and testing; Knoxville, TN (United States); 24-26 May 1995)			
1	20:23614	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013224	MF-523
2	20:23581	*See* ANL/IFR/CP-83964			
3	20:23580	*See* ANL/ED/CP-84176			
5	20:23566	*See* ANL/RE/CP-85732			
6	20:23592	*See* ANL/IFR/CP-84088			
7	20:23591	*See* ANL/IFR/CP-84087			
9	20:23514	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013975	MF-406; MF-405
10	20:23762	*See* PNL-SA-26005			
CONF-950570--		(International high-level radioactive waste management conference: progress toward understanding; Las Vegas, NV (United States); 1-5 May 1995)			
21	20:23172	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012123	MF-814
24	20:23173	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013014	MF-814
26	20:23899	*See* ANL/CMT/CP-84525			
27	20:23688	*See* ANL/EA/SUMM-84723			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-950572--		(Intergas '95: international unconventional gas symposium; Tuscaloosa, AL (United States); 15-19 May 1995)			
	20:23112	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014457	MF-132
CONF-950585--		(13. NREL photovoltaics program review meeting; Lakewood, CO (United States); 16-19 May 1995)			
1	20:23474	*See* NREL/TP-411-8005			
CONF-950587--		(17. symposium on biotechnology for fuels and chemicals; Vail, CO (United States); 7-11 May 1995)			
1	20:24643	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013991	MF-1400
CONF-950601--		(Annual meeting of the American Nuclear Society (ANS); Philadelphia, PA (United States); 25-29 Jun 1995)			
14	20:23582	*See* ANL/IFR/SUMM-85396			
15	20:24940	*See* RFP-4902			
16	20:23685	*See* SAND-95-1251C			
CONF-9506115--		(20. National Association of Environmental Professionals annual conference and exposition: environmental challenges - the next twenty years; Washington, DC (United States); 10-13 Jun 1995)			
2	20:23676	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013978	MF-402
3	20:23709	*See* WHC-SA-2722			
4	20:23663	*See* PNL-SA-25190			
6	20:23677	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013981	
7	20:23728	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013977	MF-1322
8	20:23689	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014276	
9	20:23690	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014275	MF-2000
10	20:23706	*See* PNL-SA-26159			
CONF-9506144--		(5. international conference on numerical methods in industrial forming processes (NUMIFORM); Ithaca, NY (United States); 18-21 Jun 1995)			
5	20:23875	*See* UCRL-JC-117772			
7	20:23845	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013221	MF-1420
CONF-9506175--		(Computer-based human support systems: technology, methods and future; Philadelphia, PA (United States); 25-29 Jun 1995)			
2	20:23584	*See* BNL-NUREG-61715			
3	20:23583	*See* BNL-NUREG-61712			
CONF-9506178--		(International Association of Science and Technology for Development conference on robotics and manufacturing; Cancun (Mexico); 14-17 Jun 1995)			
3	20:25033	*See* SAND-95-1168C			
CONF-9506182--		(NEPCON East '95; Boston, MA (United States); 12-15 Jun 1995)			
2	20:24041	*See* SAND-94-2593C			
CONF-9506185--		(New tools for neutron instrumentation workshop; Les Houches (France); 6-10 Jun 1995)			
2	20:24344	*See* ANL/IPNS/CP-86627			
CONF-9506191--		(6. international meeting on statistical climatology; Galway (Ireland); Jun 1995)			
1	20:24554	*See* UCRL-JC-120927			
2	20:24529	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014285	MF-402
CONF-9506193--		(16. Bioelectromagnetics Society (BEMS) annual meeting; Copenhagen (Denmark); 12-17 Jun 1995)			
Absts.	20:24739	*See* DOE/ER/61789-1			
CONF-9506198--		(International Association of Hydro-Geologists Congress: solutions; Edmonton (Canada); 4-10 Jun 1995)			
1	20:24616	*See* WSRC-MS-95-0187			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9506200–		(International Federation on Automatic Control (IFAC) symposium on nonlinear control systems design; Tahoe City, CA (United States); 25-28 Jun 1995)			
1	20:23977	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013983	MF-405
2	20:23978	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013982	MF-405
CONF-9506201–		(11. security technology symposium and exhibitioon; Virginia Beach, VA (United States); 19-22 Jun 1995)			
1	20:23396	*See* SAND–95-1245C			
3	20:23397	*See* SAND–95-1253C			
4	20:23398	*See* SAND–95-1273C			
5	20:23399	*See* SAND–95-1441C			
CONF-9506202–		(Symposium on human factors management and organization in NPP maintenance outages: impact on safety; Stockholm (Sweden); 19-22 Jun 1995)			
1	20:23534	*See* ANL/ED/CP–85916			
CONF-9506203–		(6. ICCG; The Hague (Netherlands); 18-23 Jun 1995)			
1	20:24706	*See* UCRL-JC–120183			
CONF-9506205–		(5. annual safety analysis workshop of the Energy Facility Contractors Group (EFCOG); Augusta, GA (United States); 19-23 Jun 1995)			
1	20:23359	*See* LA-UR–95-1267			
CONF-9506206–		(Very large scale integration multilevel interconnection conference; Santa Clara, CA (United States); 27-28 Jun 1995)			
1	20:24058	*See* UCRL-JC–119725			
CONF-9506208–		(ACM sigplan conference on programming language design and implementation; La Jolla, CA (United States); 18-21 Jun 1995)			
1	20:25005	*See* PNL-SA–25715			
CONF-9506209–		(2. Pacific Rim international conference on advanced materials and processing (PRICM-2); Kyongju (Korea, Republic of); 18-22 Jun 1995)			
1	20:23846	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014269	MF-404
CONF-9506210–		(10. annual Federal facilities conference; Denver, CO (United States); 29 Jun 1995)			
1	20:24550	*See* RFP–4972			
2	20:23368	*See* RFP–4971			
CONF-9506212–		(Workshop on rational design and processing of advanced ceramics; La Jolla, CA (United States); 21-23 Jun 1995)			
1	20:23867	*See* SAND–95-1287C			
CONF-9506213–		(18. transducer workshop; Colorado Springs, CO (United States); 20-22 Jun 1995)			
1	20:24004	*See* SAND–95-1272C			
CONF-9506214–		(Women in technology conference; Woodbury, NY (United States); 17-18 Jun 1995)			
1	20:23683	*See* PNL-SA–26327			
CONF-9506215–		(4. NA annual international conference on controlling arms; Philadelphia, PA (United States); 20 Jun 1995)			
1	20:23400	*See* SAND–95-8649C			
CONF-950624–		(Annual meeting of the American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE); San Diego, CA (United States); 24-28 Jun 1995)			
2	20:24027	*See* DOE/CE/23810–62A			
CONF-950634–		(26. American Institute of Aeronautics and Astronautics (AIAA) computational fluid dynamics conference; San Diego, CA (United States); 19-22 Jun 1995)			
3	20:24025	*See* UCRL-JC–118610			
4	20:24024	*See* UCRL-JC–118609			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-950646–		(Air and Waste Management Association meeting; San Antonio, TX (United States); 18-23 Jun 1995)			
23	20:22985	*See* DOE/METC/C–95/7185			
24	20:23704	*See* PNL-SA–25948			
CONF-950647–		(4. international congress on toxic combustion byproducts; Berkeley, CA (United States); 5-7 Jun 1995)			
1	20:23520	*See* ANL/ES/CP–84609			
CONF-950653–		(1995 American control conference; Seattle, WA (United States); Jun 1995)			
2	20:24002	*See* SAND–95-1195C			
3	20:24708	*See* PNL-SA–26069			
CONF-950660–		(International conference on exotic nuclei and atomic masses; Arles (France); 19-23 Jun 1995)			
1	20:24806	*See* BNL–61912			
2	20:24807	*See* BNL–61913			
CONF-950691–		(14. international conference on magnet technology; Tampere (Finland); 11-16 Jun 1995)			
2	20:24186	*See* FNAL/C–95/143			
5	20:24179	*See* BNL–61362			
CONF-950705–		(HEP 95: international Europhysics conference on high-energy physics; Brussels (Belgium); 21-27 Jul 1995)			
1	20:24354	*See* FNAL/C–177-E			
CONF-9507122–		(CLEO/Pacific Rim coal conference; Makuhar (Japan); 11-14 Jul 1995)			
2	20:24047	*See* SAND–95-8550C			
CONF-9507125–		(BEM 17: Boundary element methods; Madison, WI (United States); 17-19 Jul 1995)			
2	20:24023	*See* SAND–95-1196C			
CONF-9507127–		(National Instruments week; Austin, TX (United States); 23 Jul 1995)			
1	20:24005	*See* SAND–95-8564C			
CONF-9507130–		(26. national symposium on fracture mechanics; Idaho Falls, ID (United States); 27 Jul 1995)			
1	20:23574	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013207	
CONF-9507134–		(IEEE Industrial Electronics Society conference; Athens (Greece); 10-14 Jul 1995)			
1	20:23939	*See* ANL/ET/CP–84607			
CONF-9507135–		(7. international conference on computing and information; Ontario (Canada); 5-8 Jul 1995)			
1	20:25020	*See* ANL/DIS/CP–86615			
CONF-9507136–		(16. international congress on instrumentation in aerospace simulation facilities; Dayton, OH (United States); 18-21 Jul 1995)			
1	20:24022	*See* SAND–95-1189C			
CONF-9507137–		(Institute of Electrical and Electronics Engineers (IEEE) transactions on nuclear science: NSRE conference; Madison, WI (United States); 12 Jul 1995)			
1	20:24827	*See* SAND–95-1338C			
CONF-950715–		(9. international conference on numerical methods in laminar and turbulent flow; Atlanta, GA (United States); 10-14 Jul 1995)			
1	20:24432	*See* SAND–95-1364C			
CONF-950718–		(Electric Power Research Institute low-level waste conference; Orlando, FL (United States); 10-12 Jul 1995)			
1	20:23949	*See* UCRL-JC–119844			
CONF-950720–		(AIAA/SAE/ASME joint propulsion conference and exhibit; San Diego, CA (United States); 10-12 Jul 1995)			
5	20:24416	*See* SAND–95-0968C			
6	20:24431	*See* SAND–94-2814C			
CONF-950722–		(Cryogenic engineering conference and international cryogenic materials conference; Columbus, OH (United States); 17-21 Jul 1995)			
2	20:24328	*See* LBL–35890			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-950728–		(1. European meeting on integrated ferroelectricity; Nijmegen (Netherlands); 4-8 Jul 1995)			
1	20:24045	*See* SAND–95-1374C			
CONF-950729–		(30. Intersociety energy conversion conference; Orlando, FL (United States); 30 Jul - 5 aug 1995)			
7	20:23166	*See* ANL/CMT/CP–86433			
9	20:23665	*See* ANL/ET/CP–84772			
10	20:23559	*See* LA-UR–95-1383			
CONF-950731–		(8. international symposium on transport phenomena in combustion: San Francisco, CA (United States); 16-20 Jul 1995)			
1	20:23973	*See* SAND–95-8497C			
CONF-950740–		(Joint ASME/JSME pressure vessels and piping conference; Honolulu, HI (United States); 23-27 Jul 1995)			
46	20:23170	*See* BNL–61647			
49	20:23593	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013043	MF-520
51	20:23567	*See* BNL-NUREG–61789			
52	20:23256	*See* WHC-SA–2737			
53	20:24959	*See* ANL/RE/CP–86315			
54	20:24012	*See* UCRL-JC–120300			
55	20:24957	*See* ANL/RE/CP–86223			
56	20:24742	*See* ANL/RE/CP–86338			
58	20:24958	*See* ANL/RE/CP–86314			
59	20:24741	*See* ANL/RE/CP–85743			
60	20:23339	*See* ANL/RE/CP–85754			
65	20:23565	*See* ANL/ET/CP–84157			
66	20:23847	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014273	
67	20:24740	*See* SAND–95-0347C			
68	20:24942	*See* SAND–95-0328C			
69	20:23586	*See* BNL–61458			
CONF-950787–		(36. annual meeting of the Institute for Nuclear Materials Management; Palm Desert, CA (United States); 9-12 Jul 1995)			
3	20:23829	*See* BNL–61395			
5	20:23406	*See* ANL/TD/CP–85177			
6	20:23394	*See* RHP–4973			
CONF-950793–		(40. annual meeting of the Society of Photo-Optical Instrumentation Engineers: international symposium on optical science, engineering and instrumentation; San Diego, CA (United States); 9-14 Jul 1995)			
1	20:24450	*See* ANL/ET/CP–85044			
2	20:23395	*See* SAND–94-3151C			
2	20:24062	*See* ANL/ED/CP–86766			
3	20:23970	*See* ANL/CHM/CP–86825			
5	20:24836	*See* BNL–61928			
6	20:24380	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014595	MF-406
CONF-950801–		(210. national meeting of the American Chemical Society; Chicago, IL (United States); 20-25 Aug 1995)			
1	20:23961	*See* LA-UR–95-1304			
2	20:23926	*See* SAND–95-0933C			
3	20:23000	*See* SAND–95-1124C			
4	20:22983	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014282	MF-401
CONF-9508119–		(1. international symposium on assembly and task planning; Pittsburgh, PA (United States); 10-11 Aug 1995)			
1	20:24000	*See* SAND–95-0849C			
2	20:24003	*See* SAND–95-1235C			
CONF-9508122–		(24. international cosmic rays conference (ICRC); Rome (Italy); 28 Aug - 8 sep 1995)			
2	20:24826	*See* LBL–37201			
3	20:24811	*See* LBL–37254			
CONF-9508134–		(International symposium on phase transformations during thermal/mechanical processing of steel; Vancouver (Canada); 20-23 Aug 1995)			
1	20:23849	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014284	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-950816–		(7. NACE international symposium on environmental degradation of materials in nuclear power plants: water reactors; Breckenridge, CO (United States); 6-10 Aug 1995)			
1	20:23878	*See* WAPD-T–3054			
2	20:23879	*See* WAPD-T–3055			
CONF-950828–		(National heat transfer conference; Portland, OR (United States); 5-9 Aug 1995)			
11	20:23489	*See* SAND–95-1106			
12	20:23607	*See* SAND–95-1107C			
13	20:24018	*See* ANL/IFR/CP–84612			
CONF-950833–		(10. international conference on composite materials; Whistler (Canada); 14-18 Aug 1995)			
2	20:23876	*See* UCRL-JC–119347			
CONF-950839–		(Conference on particulate control/managing hazardous air pollutants; Toronto (Canada); 15-18 Aug 1995)			
1	20:23944	*See* DOE/MC/30024–95/C0495			
CONF-950840–		(International conference on applications of diamond films and related materials; Gaithersburg, MD (United States); 21-24 Aug 1995)			
2	20:23915	*See* LA-UR–95-1245			
CONF-950853–		(ASME/JSME annual summer meeting of the Fluids Engineering conference; Hilton Head, SC (United States); 13-17 Aug 1995)			
3	20:23942	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013039	MF-401
5	20:24617	*See* BNL–61801			
6	20:24383	*See* DOE/METC/C–95/7186			
CONF-950857–		(Society of Automotive Engineers future transportation technology conference and exposition; Costa Mesa, CA (United States); 7-10 Aug 1995)			
1	20:23815	*See* SAND–95-1125C			
2	20:23816	*See* UCRL-JC–120308			
CONF-950865–		(29. annual meeting of the Microbeam Analysis Society; Breckenridge, CO (United States); 6-11 Aug 1995)			
4	20:23165	*See* ANL/CMT/CP–86025			
CONF-950875–		(International symposium on plasma chemistry; Minneapolis, MN (United States); 21-25 Aug 1995)			
1	20:24553	*See* UCRL-JC–120645			
2	20:23818	*See* UCRL-JC–120646			
CONF-950876–		(19. annual symposium of the Nuclelar Information Records Management Association; Washington, DC (United States); 27-30 Aug 1995)			
1	20:25031	*See* SAND–95-0336C			
CONF-950877–		(3. American Society for Mechanical Engineers biannual mixed waste symposium; Baltimore, MD (United States); 7-11 Aug 1995)			
12	20:23948	*See* UCRL-JC–119739			
13	20:23360	*See* LA-UR–95-1390			
CONF-950892–		(53. annual meeting of Microscopy Society of America; Kansas City, KS (United States); 13-17 Aug 1995)			
7	20:23848	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013038	MF-404
8	20:24884	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013036	MF-404; MF-420
CONF-9509100–		(5. international conference on nuclear criticality safety; Albuquerque, NM (United States); 17-22 Sep 1995)			
2	20:23594	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014600	MF-900
CONF-9509118–		(Modeling of casting, welding and advanced solidification processes 7; London (United Kingdom); 10-15 Sep 1995)			
3	20:23869	*See* SAND–95-8513C			
4	20:23871	*See* SAND–95-8534C			
6	20:23850	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013220	MF-404; MF-405

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
7	20:24009	*See* UCRL-JC–118185			
CONF-9509131–		(22. annual National Energy and Environmental Division education and training symposium; Charlotte, NC (United States); 17-20 Sep 1995)			
2	20:23251	*See* UCRL-JC–120966			
CONF-9509140–		(15. ASME international computer in engineering conference; Boston, MA (United States); 17-21 Sep 1995)			
1	20:23794	*See* KCP–613-5587			
2	20:24001	*See* SAND–95-0935C			
CONF-9509156–		(Annual meeting of the Society for Applied Spectroscopy; Philadelphia, PA (United States); 17-21 Sep 1995)			
1	20:24713	*See* ANL/EQO/SUMM–85950			
CONF-950917–		(5. international conference on radioactive waste management and environmental remediation; Berlin (Germany); 3-9 Sep 1995)			
12	20:23969	*See* UCRL-ID–119263			
CONF-9509172–		(Engineering in Medicine and Biology Society (EMBS) conference; Montreal (Canada); 20-23 Sep 1995)			
1	20:24704	*See* UCRL-JC–120641			
CONF-9509182–		(1995 National thermal spray conference; Houston, TX (United States); 11-15 Sep 1995)			
1	20:23889	*See* DOE/MC/30244–95/C0481			
2	20:24031	*See* SAND–95-0008C			
CONF-950927–		(International conference and workshop on modeling and mitigating the consequences of accidental releases of hazardous materials; New Orleans, LA (United States); 26-29 Sep 1995)			
2	20:24451	*See* BNL–61619			
4	20:24552	*See* UCRL-JC–120469			
CONF-950955–		(10. international conference on heavy metals in the environment; Hamburg (Germany); 18-22 Sep 1995)			
1	20:23499	*See* BNL–61285			
CONF-950985–		(14. Institute of Electrical and Electronics Engineers (IEEE) symposium on mass storage systems; Monterey, CA (United States); 11-14 Sep 1995)			
1	20:25015	*See* UCRL-JC–119772			
CONF-950987–		(Electrical/electronics insulation conference; Chicago, IL (United States); 18-21 Sep 1995)			
1	20:24044	*See* SAND–95-1165C			
CONF-951001–		(16. World Energy Council congress; Makuhari (Japan); 8-13 Oct 1995)			
1	20:24885	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009078	MF-420
CONF-951006–		(Winter meeting of the American Nuclear Society; San Francisco, CA (United States); 29 Oct - 1 nov 1995)			
1	20:23635	*See* SAND–95-1036C			
2	20:23634	*See* SAND–95-1035C			
3	20:24832	*See* SAND–95-1239C			
4	20:24831	*See* SAND–95-1232C			
10	20:24566	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014577	MF-2010
CONF-951007–		(188. meeting of the Electrochemical Society; Chicago, IL (United States); 8-13 Oct 1995)			
1	20:23747	*See* LA-UR–95-1352			
2	20:23746	*See* LA-UR–95-1351			
CONF-9510125–		(International symposium on environmental technologies: plasma systems and applications; Atlanta, GA (United States); 8-11 Oct 1995)			
1	20:23177	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012896	MF-2070
CONF-951013–		(Annual meeting of the Society of Exploration Geophysicists; Houston, TX (United States); 8-12 Oct 1995)			
1	20:24749	*See* SAND–95-8591			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9510137–		(Parallel rendering symposium; Atlanta, GA (United States); 24 Oct 1995)			
1	20:24997	*See* LA-UR–95-1169			
CONF-9510141–		(Institute for Electrical and Electronics Engineers visualization '95; Atlanta, GA (United States); 30 Oct - 3 nov 1995)			
1	20:25016	*See* UCRL-JC–120527			
2	20:25017	*See* UCRL-JC–120528			
CONF-9510158–		(8. international symposium on transport properties; San Francisco, CA (United States); Oct 1995)			
1	20:23416	*See* UCRL-JC–120677			
CONF-9510171–		(PMI '95: Project Management Institute conference; New Orleans, LA (United States); 13-19 Oct 1995)			
2	20:24944	*See* SAND–95-0908C			
3	20:24946	*See* SAND–95-0942C			
CONF-951026–		(Fall meeting of the Minerals, Metals and Materials Society: physical metallurgy and materials; Cleveland, OH (United States); 29 Oct - 2 nov 1995)			
1	20:23916	*See* LA-UR–95-1463			
2	20:23918	*See* LA-UR–95-1520			
3	20:23917	*See* LA-UR–95-1464			
CONF-951033–		(27. international technical conference of the Society for the Advancement of Material and Process Engineering: diversity into the next century; Albuquerque, NM (United States); 9-12 Oct 1995)			
1	20:23925	*See* SAND–95-0869C			
3	20:23669	*See* SAND–95-1313C			
CONF-951037–		(Annual meeting of the Geothermal Resources Council; Reno, NV (United States); 8-11 Oct 1995)			
1	20:23497	*See* SAND–95-1289C			
CONF-951048–		(International conference and exhibit of the Instrument Society of America; New Orleans, LA (United States); 2-5 Oct 1995)			
1	20:23145	*See* WHC-SA–2856			
CONF-951073–		(IEEE nuclear science symposium and medical imaging conference; San Francisco, CA (United States); 21-28 Oct 1995)			
1	20:24345	*See* BNL–61687			
2	20:24348	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012875	MF-414; MF-413
4	20:24349	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012878	MF-406; MF-413; MF-414
5	20:24033	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012877	MF-406
CONF-951092–		(Human Factors and Ergonomics Society meeting; San Diego, CA (United States); 9-13 Oct 1995)			
1	20:24929	*See* SAND–95-0348C			
2	20:25030	*See* SAND–95-0226C			
CONF-951098–		(5. international symposium on land subsidence; The Hague (Netherlands); 16-20 Oct 1995)			
1	20:23067	*See* SAND–95-0222C			
CR-B–					
95-05	20:23678	OSTI		TI95012977	PC-960
CRIE-R–					
93006	20:23679	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790566	
93016	20:25023	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790578	
93017	20:23680	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790564	

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CRIE-T–					
93079	20:23666	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790573	
CRIE-U–					
94011	20:24710	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790541	
94017	20:24625	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790561	
94020	20:24711	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790554	
CRIE-W–					
93033	20:23802	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790558	
94004	20:23776	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790556	
CRIE-Y–					
94006	20:23681	OSTI; NTIS; Available from Central Research Institute of Electric Power Industry, 1-6-1, Otemachi, Chiyoda-ku, Tokyo, Japan		DE95790544	
CTH-RF–					
109	20:24350	OSTI; NTIS; INIS		DE95632454	
DESY-HERA–					
92-01	20:24148	*See* SSCL–564			
DLR-FB–					
94-18	20:24530	OSTI; NTIS (US Sales Only)		DE95791278	
DOE-STD–					
0028-95	20:24887	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014645	MF-420
DOE-TSL–					
1-95	20:24935	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015401	MF-500
4-95	20:24936	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015703	MF-500
DOE/AL–					
94598-1	20:23777	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010689	PC-1419
DOE/AL/62350–					
157-Rev.	20:23340	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015575	MF-2070
171	20:23317	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016204	MF-2010
179	20:23341	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013503	MF-2010
187	20:24568	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013796	MF-2050
188	20:23342	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013502	MF-2010
191	20:23318	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013501	MF-2010
99-Rev.1	20:24567	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015576	MF-2070
DOE/AL/65030–					
9421	20:24413	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013542	MF-706
9505	20:24414	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013543	MF-741
DOE/AL/82993–					
9	20:23654	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013803	MF-1290
12	20:23494	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013806	MF-1290
13	20:23480	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013807	MF-1290
19	20:23481	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014980	MF-1290
22	20:23482	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014977	MF-1290
DOE/AL/85832–					
T3	20:23382	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015501	MF-900
T4	20:24569	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015524	MF-721

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T5	20:24570	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015525	MF-721
T6	20:23383	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015526	MF-721
T7	20:23384	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015527	MF-721
DOE/AL/87310–					
1	20:23127	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014709	MF-1400
DOE/AL/98817–					
3	20:24034	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015512	MF-906
DOE/BC–					
95000151	20:23063	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000151	PC-122
95000152	20:23064	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000152	PC-122
95000153	20:23065	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000153	PC-122
95000168	20:23088	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000168	PC-122
95000169	20:23089	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000169	PC-122
DOE/BC/14477–					
18	20:23070	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000164	PC-122
DOE/BC/14649–					
8	20:23050	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015485	MF-122
9	20:23051	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015484	MF-122
11	20:23052	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015483	MF-122
12	20:23053	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015482	MF-122
DOE/BC/14858–					
2	20:24744	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016226	MF-122
DOE/BC/14862–					
10	20:23071	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000163	PC-122
DOE/BC/14864–					
14	20:23072	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000162	PC-122
DOE/BC/14881–					
12	20:23073	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000158	PC-122
DOE/BC/14883–					
T2	20:24745	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014915	MF-122
DOE/BC/14884–					
12	20:23074	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000157	PC-122
DOE/BC/14885–					
10	20:23075	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000180	PC-122
DOE/BC/14891–					
7	20:23054	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014951	MF-122
DOE/BC/14892–					
5	20:23076	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000148	PC-122
7	20:23055	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014956	MF-122
DOE/BC/14896–					
6	20:23056	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000172	PC-122
7	20:23057	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014952	MF-122
DOE/BC/14897–					
7	20:23077	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013819	MF-122
DOE/BC/14899–					
24	20:23078	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000165	PC-122
25	20:23079	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000150	PC-122
26	20:23080	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000149	PC-122
27	20:23081	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000166	PC-122
28	20:23082	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000167	PC-122
DOE/BC/14953–					
10	20:23058	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000171	PC-122
DOE/BC/14954–					
5	20:23059	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000170	PC-122
DOE/BC/14957–					
8	20:23083	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014905	MF-122
DOE/BC/14959–					
13	20:23060	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000160	PC-122
DOE/BC/14960–					
8	20:23084	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000173	PC-122
9	20:23085	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014911	MF-122
DOE/BC/14961–					
7	20:23061	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016212	MF-122
DOE/BC/14962–					
7	20:23086	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000177	PC-122
DOE/BC/14963–					
8	20:23087	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014910	MF-122
DOE/BC/14971–					
3	20:23128	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014954	MF-122

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DOE/BC/14982–					
3	20:23062	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016213	MF-122
DOE/BP–					
2504	20:24925	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014449	MF-900
2586	20:24571	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014643	MF-1220
2588	20:23465	*See* DOE/EIS–0169-Rev.			
2589	20:23452	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014756	MF-630
DOE/BP/00276–					
2	20:23450	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014444	MF-902
DOE/BP/01385–					
5	20:23451	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014446	MF-1200
DOE/BP/10891–					
2	20:23453	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014363	MF-1220
DOE/BP/11631–					
10	20:23454	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014411	MF-1220
DOE/BP/11982–					
5	20:23455	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014448	MF-402
DOE/BP/21182–					
5	20:23456	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014408	MF-1220
DOE/BP/21708–					
3	20:24626	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014440	MF-902
DOE/BP/25105–					
2	20:23457	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014417	MF-902
DOE/BP/35768–					
4	20:23458	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013842	MF-902
5	20:23459	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014410	MF-1220
DOE/BP/41841–					
2	20:23460	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014415	MF-902
DOE/BP/91819–					
10	20:23461	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014445	MF-902
DOE/BP/92818–					
4	20:24627	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014442	MF-902
DOE/BP/93743–					
1	20:23462	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014443	MF-902
DOE/CAO–					
2056-Vol.1-Draft	20:23178	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012433	MF-2000
2056-Vol.2-Draft	20:23179	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012436	MF-2000
2056-Vol.3-Draft	20:23180	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012437	MF-2000
2056-Vol.4-Draft	20:23181	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012754	MF-2000
2056-Vol.5-Draft	20:23343	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012434	MF-2000
2056-Vol.6-Draft	20:23319	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012435	MF-2000
2056-Vol.7-Draft	20:23320	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012752	MF-2000
2056-Vol.8-Draft	20:23321	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012753	MF-2000
2056-Vol.9-Draft	20:23322	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012755	MF-2000
DOE/CE/15452–					
T1	20:23778	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015460	MF-1407
DOE/CE/15544–					
T11	20:23417	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013820	MF-1401
DOE/CE/15605–					
T3	20:24398	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015543	MF-1213
DOE/CE/23810–					
46	20:23952	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013301	MF-1600

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51F	20:23979	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015361	MF-1416
59	20:23980	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016148	MF-1600
60	20:23779	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014710	MF-1600
62A	20:24027	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015263	MF-1425
DOE/CE/26515–					
T1	20:23803	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009801	MF-1330
DOE/CE/40839–					
T3	20:23780	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015552	PC-1400
DOE/CE/50389–					
1	20:23813	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009675	MF-1360; MF-1502; MF-1504
DOE/CH/10093–					
322-Rev.2	20:23804	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006897	MF-1414
DOE/CH/10330–					
T1	20:24716	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014926	MF-708
DOE/EA–					
0683	20:23344	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014000	MF-630
0848	20:24065	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012128	MF-630
0909	20:24303	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012130	MF-630
0969	20:23691	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012126	MF-630; MF-702
0971	20:23827	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014001	MF-630
1030	20:23323	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012247	MF-2070; MF-630
1040	20:23463	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014998	MF-630
DOE/EE–					
0064	20:23748	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015578	MF-1600
0066	20:23749	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016234	MF-1600
DOE/EE/15623–					
T1	20:23515	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014975	MF-1414
DOE/EH–					
0497	20:23345	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015935	MF-607
231-056/1294	20:23781	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015487	MF-600
231-057/1294	20:23782	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015488	MF-600
231-058/1294	20:23783	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015489	MF-600
231-059/1294	20:23692	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015491	MF-600
231-060/1294	20:23784	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015490	MF-600
95010741	20:23693	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010741	MF-600
95015009	20:23694	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015009	PC-630
DOE/EH/79003–					
T3	20:24572	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014970	MF-630
T4	20:24573	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014969	MF-630
T5	20:24574	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014968	MF-630
DOE/EIA–					
0035(95/06)	20:23739	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95014485	MF-950
0035(95/07)	20:23710	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95015816	MF-950
0109(95/06)	20:23097	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95014526	MF-950
0191(94)	20:23729	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95015577	MF-950
0214(93)	20:23740	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015164	MF-950
0226(95/06)	20:23730	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95014402	MF-950
0314(93)	20:23750	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014557	MF-1600
0380(95/07)	20:23098	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95014949	MF-950
0484(95)	20:23720	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95014139	MF-950
0520(95/06)	20:23099	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95014555	MF-950
0543(95/1Q)	20:23100	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE95014360	MF-950

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/EIA–					
0569(95/1Q)	20:25024	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014357	MF-950
M068(95)App.	20:23731	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014356	MF-950
DOE/EIS–					
0169	20:23452	*See* DOE/BP–2589			
0169	20:23464	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014364	MF-630
0169-Rev.	20:23465	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015000	MF-630
0173-FINAL	20:23662	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016113	MF-630
0182	20:23732	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014997	MF-630
0203-F-Vol.1-App.L	20:23324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012042	MF-630
0206-App.B	20:23502	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012241	MF-1210; MF-630
0206-App.C	20:23500	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012242	MF-1210; MF-630
0206-App.D	20:23503	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012243	MF-1210; MF-630
0217-Vol.1	20:23695	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015754	MF-630
0218D-Vol.2-App.F	20:23826	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012343	MF-2000
0226	20:23325	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012245	MF-630
0228D	20:24426	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012204	MF-630
0232	20:23696	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012125	MF-630
DOE/EM–					
0238	20:23182	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013582	MF-2000
0240	20:24932	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014140	MF-2000
0248	20:24575	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016125	MF-2010
0249	20:23183	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016004	MF-2000
0250	20:23346	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016130	MF-2000
0252	20:23347	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016003	MF-2020
0253	20:23348	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016002	MF-2050
0255	20:23349	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016251	MF-2030
0257	20:23350	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016164	MF-2000
DOE/ER–					
0649T	20:23712	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015971	MF-402
0650T	20:24531	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014935	MF-402
45529	20:23851	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015362	MF-404
DOE/ER/10690–					
11	20:24774	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016073	MF-414
12	20:24775	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016070	MF-414
DOE/ER/12900–					
1	20:23615	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014739	MF-406
DOE/ER/13031–					
T1	20:24828	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014929	MF-405; MF-413
DOE/ER/13439–					
T5	20:23953	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013504	MF-401
DOE/ER/13442–					
9	20:23954	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013818	MF-412
DOE/ER/13460–					
2	20:23955	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014702	MF-401
T3	20:23956	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014547	MF-401
DOE/ER/13602–					
7	20:24681	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014493	MF-408
DOE/ER/13614–					
T3	20:23419	OSTI; NTIS; GPO Dep.	E 1.99:	DE95006423	MF-408
T4	20:23420	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008038	MF-408
DOE/ER/13662–					
T3	20:23908	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012448	MF-406
DOE/ER/13670–					
T5	20:24761	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013840	MF-412

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/13712–					
4	20:23421	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013811	MF-408
DOE/ER/13757–					
T6	20:24019	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015455	MF-406
DOE/ER/13937–					
7	20:24839	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014540	MF-401
DOE/ER/13969–					
3	20:23468	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013801	MF-408
DOE/ER/13970–					
T2	20:24644	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012192	MF-408
T3	20:24645	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012191	MF-408
DOE/ER/14045–					
10	20:24020	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013812	MF-406
DOE/ER/14059–					
2	20:23422	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014706	MF-408
T1	20:23418	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015475	MF-408
DOE/ER/14071–					
4	20:24646	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014343	MF-408
DOE/ER/14084–					
4	20:23066	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016149	MF-405; MF-403
DOE/ER/14315–					
T2	20:23943	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015116	MF-401
DOE/ER/14379–					
T1	20:23667	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015502	MF-406
DOE/ER/14402–					
7	20:24837	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015513	MF-411
DOE/ER/20034–					
2	20:24647	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015430	MF-408
3	20:24648	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015429	MF-408
DOE/ER/25138–					
T1	20:24979	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013078	MF-405
DOE/ER/25181–					
T1	20:24847	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012412	MF-405; MF-403
DOE/ER/25212–					
T1	20:24649	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015463	MF-401
DOE/ER/40272–					
213	20:24776	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010162	MF-414
DOE/ER/40537–					
37	20:24805	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015920	MF-413
43	20:24762	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015921	MF-412
DOE/ER/40561–					
193	20:24782	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012174	MF-414; MF-413
DOE/ER/40678–					
T2	20:24351	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014541	MF-406
DOE/ER/40771–					
T1	20:24787	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016141	MF-413
DOE/ER/45278–					
4	20:24035	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013303	MF-404
T3	20:23909	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013306	MF-404
T4	20:23910	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013305	MF-404
DOE/ER/53198–					
261	20:24860	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015953	PC-426
DOE/ER/53299–					
1	20:24861	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013813	MF-426; MF-427
DOE/ER/54177–					
T3	20:24886	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014301	MF-415
DOE/ER/54241–					
2	20:24862	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016229	MF-420
DOE/ER/60376–					
T4	20:24628	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014741	MF-402
DOE/ER/60397–					
7	20:24532	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015922	MF-402
DOE/ER/60455–					
8	20:24717	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014982	MF-408
9	20:24718	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014699	MF-408
DOE/ER/61040–					
3	20:24650	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016134	MF-408

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/61040–					
4	20:24651	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016135	MF-408
T1	20:24652	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016136	MF-408
DOE/ER/61252–					
T2	20:24696	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013304	MF-402
DOE/ER/61666–					
2	20:24728	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015511	MF-402
DOE/ER/61789–					
1	20:24739	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013088	MF-408
DOE/ER/61792–					
1	20:24682	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012425	MF-400; MF-408
DOE/ER/61888–					
1	20:24576	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008993	MF-402
DOE/ER/75388–					
T1	20:23131	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015477	MF-413
DOE/ER/75665–					
2	20:24926	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015506	MF-400
3	20:24927	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015588	MF-400
DOE/ER/75873–					
T1	20:24758	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015112	MF-420
DOE/ER/75884–					
T1	20:23595	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015453	MF-406
DOE/ER/79148–					
T1	20:23596	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015538	MF-413
DOE/ET/53088–					
689	20:24980	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015448	MF-405
701	20:24863	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009556	MF-421
DOE/EW/50625–					
T22	20:24729	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012199	MF-2010
T23	20:24730	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016210	MF-2010
T24	20:24731	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016211	MF-2010
DOE/GO–					
10095-179	20:23413	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009213	MF-1360
DOE/GO/10039–					
1	20:23414	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009192	MF-1250; MF-1360; MF-1502; MF-15
DOE/GO/10044–					
1	20:23751	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015479	MF-1600
DOE/ID/12624–					
3	20:23785	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015551	PC-1419
DOE/ID/12735–					
T35	20:24577	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013077	MF-2010
DOE/ID/13052–					
1	20:23752	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015481	MF-1416
DOE/ID/13074–					
T16	20:23814	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015960	MF-1501
DOE/ID/13236–					
T1	20:23911	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015157	MF-1400
DOE/IG–					
0002/95	20:23722	OSTI		TI95013666	PC-960
0374	20:24933	OSTI (Free of Charge)		TI95015589	PC-960
0375	20:24427	OSTI (Free of Charge)		TI95014850	PC-960
DOE/MC–					
25031-95/C0453	20:23113	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012314	MF-132
85000-95/C0477	20:23111	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012983	MF-132
92113-4016	20:23981	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000086	PC-2060

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/MC/13223–					
95/C0484	20:23122	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015007	MF-132
DOE/MC/21023–					
4008-Vol.1	20:23028	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000080	MF-103
4008-Vol.2	20:23029	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014418	MF-103
DOE/MC/25140–					
4053	20:23013	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014479	MF-106; MF-109
DOE/MC/26025–					
95/C0475	20:23114	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012981	MF-132
DOE/MC/26026–					
95/C0482	20:23115	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014576	MF-132
DOE/MC/26042–					
4059	20:23014	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015514	MF-106
DOE/MC/26288–					
4060	20:23015	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014947	MF-105
DOE/MC/27229–					
4055	20:23030	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014976	MF-103
DOE/MC/27346–					
95/C0480	20:23123	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014024	MF-131
DOE/MC/27391–					
4057	20:22984	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014923	MF-109
DOE/MC/28133–					
95/C0485	20:23116	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014481	MF-132
DOE/MC/28162–					
4015	20:23016	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000085	MF-113; MF-107
DOE/MC/28182–					
95/C0489	20:23117	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015006	MF-132
DOE/MC/29077–					
95/C0490	20:23118	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014985	MF-132
DOE/MC/29228–					
4070	20:23433	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009716	MF-125
DOE/MC/29249–					
4074	20:23184	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95009720	MF-2020
DOE/MC/29309–					
4056	20:23516	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009708	MF-109
4063	20:23517	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009709	MF-109
DOE/MC/29467–					
4080	20:23351	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009726	MF-2000
DOE/MC/30024–					
95/C0495	20:23944	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014986	MF-104
DOE/MC/30127–					
4061	20:23090	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014924	MF-113; MF-122; MF-107; MF-132
4062	20:23091	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014922	MF-113; MF-122; MF-132; MF-107
DOE/MC/30244–					
95/C0481	20:23889	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012913	MF-106; MF-114; MF-111
DOE/MC/30251–					
4068	20:23017	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009714	MF-105
DOE/MC/30252–					
4077	20:23018	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009723	MF-106
DOE/MC/31112–					
95/C0488	20:23126	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014340	MF-131
DOE/MC/31162–					
95/C0465	20:23119	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012311	MF-131
DOE/MC/31224–					
4052	20:23110	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000096	MF-132
DOE/MC/31327–					
95/C0451	20:23518	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012295	MF-104; MF-111

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/MC/50249–					
95/C0486	20:23434	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015004	MF-132
DOE/METC/C–					
95/7185	20:22985	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014482	MF-109
95/7186	20:24383	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014564	MF-115
95/7191	20:23108	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014934	MF-131
DOE/MT/92007–					
9	20:23092	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000175	PC-122
DOE/MT/92008–					
10	20:23101	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000179	PC-122
DOE/MT/92009–					
12	20:23104	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014953	MF-122
DOE/MT/92010–					
8	20:23102	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012550	MF-122
10	20:23103	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000176	PC-122
DOE/MT/92011–					
12	20:23093	OSTI; NTIS; GPO Dep.	E 1.99:	DE95000178	PC-122
DOE/MT/92020–					
10	20:23094	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014904	MF-122
DOE/NE/37967–					
T10	20:23982	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012909	MF-520
DOE/NE/37969–					
6	20:23786	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015194	MF-520
DOE/NV–					
383	20:24428	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014358	MF-700
DOE/NV/10845–					
53	20:24578	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013100	MF-703
DOE/NV/11432–					
181	20:24934	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014556	MF-700
DOE/OR–					
2006	20:24579	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016400	MF-2010
DOE/OR/00033–					
T641	20:24700	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015635	MF-900; MF-000
T655	20:23682	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015626	MF-900
T656	20:24701	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015625	MF-900; MF-000
DOE/OR/21548–					
436-Rev.	20:23352	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015486	MF-511
DOE/OR/21999–					
T2	20:23655	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014990	MF-700
DOE/OR/22028–					
T19	20:24580	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015262	MF-2000
DOE/OR/22041–					
T2	20:23890	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013505	MF-114
DOE/PC/79650–					
T48	20:23031	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015542	MF-104
DOE/PC/79669–					
T3	20:23742	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015540	MF-112
DOE/PC/79903–					
T19-Vol.1	20:23032	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016152	MF-104
T19-Vol.2	20:23033	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016153	MF-104
DOE/PC/88697–					
T11	20:23034	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015608	MF-104
DOE/PC/90011–					
T1	20:23435	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014801	MF-108
T10	20:23444	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014810	MF-108
T2	20:23436	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014802	MF-108
T3	20:23437	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014803	MF-108
T30	20:22986	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015620	MF-108
T4	20:23438	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014804	MF-108
T5	20:23439	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014805	MF-108
T6	20:23440	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014806	MF-108
T7	20:23441	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014807	MF-108
T8	20:23442	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014808	MF-108
T9	20:23443	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014809	MF-108
DOE/PC/90054–					
T13	20:22987	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014749	MF-113
T17	20:22988	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015961	MF-113

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/PC/90278–					
T1	20:23035	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016147	MF-104
T2	20:23036	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016146	MF-104
T3	20:23037	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016145	MF-104
T4	20:23038	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016144	MF-104
T5	20:23039	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016143	MF-104
DOE/PC/91029–					
T7	20:22989	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015618	MF-108
DOE/PC/91030–					
T10	20:23958	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014337	MF-131
T11	20:23959	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014336	MF-131
T12	20:23960	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014335	MF-131
T9	20:23957	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014338	MF-131
DOE/PC/91043–					
T13	20:22980	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015452	MF-108
DOE/PC/91058–					
T14	20:22990	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015623	MF-108
DOE/PC/91155–					
T10	20:23519	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015617	MF-104
DOE/PC/91297–					
T10	20:23025	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016287	MF-117
DOE/PC/91304–					
T13	20:22991	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015605	MF-108
DOE/PC/91338–					
T10	20:23522	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016678	MF-105
DOE/PC/91344–					
T11	20:23523	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014328	MF-105
T12	20:23019	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014989	MF-105
DOE/PC/91346–					
10	20:23524	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015602	MF-105
DOE/PC/92104–					
T10	20:23002	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015516	MF-125
DOE/PC/92108–					
T8	20:22992	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014321	MF-108
DOE/PC/92109–					
T8	20:22993	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015615	MF-113
DOE/PC/92119–					
T7	20:22994	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015515	MF-108
DOE/PC/92121–					
T9	20:22995	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015478	MF-108
DOE/PC/92159–					
T12	20:23040	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015619	MF-113
DOE/PC/92529–					
T10	20:22996	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015604	MF-108
DOE/PC/92542–					
T10	20:23852	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015957	MF-114
DOE/PC/92543–					
T10	20:22981	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015535	MF-102
DOE/PC/92578–					
T8	20:23026	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015611	MF-117
DOE/PC/93053–					
T3	20:22997	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016283	MF-108
DOE/PC/93069–					
4	20:22998	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016676	MF-108
DOE/PC/93202–					
5	20:23003	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015510	MF-113
DOE/PC/93219–					
T5	20:23891	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015606	MF-110
DOE/PC/93220–					
T6	20:23001	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015616	MF-105
DOE/PC/94116–					
T4	20:23041	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015609	MF-102
DOE/PC/94122–					
T2	20:23042	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015536	MF-104
DOE/PC/94222–					
2	20:23912	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015603	MF-114
DOE/PN/38195–					
T2	20:24021	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015702	MF-505
DOE/PO/10221–					
T1	20:23637	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015456	MF-900

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/R2/15469–					
T8	20:23753	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015458	MF-1400
DOE/R4/10591–					
1	20:23423	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009646	MF-1311
DOE/R4/10610–					
T1	20:23754	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015454	MF-1600
DOE/R7/01314–					
T7	20:24036	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014927	MF-1400
DOE/RL–					
93-64-Rev.2	20:24581	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012047	MF-2000
93-66	20:23697	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014919	MF-2000; MF-630
94-61-Vol.1	20:23353	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014150	MF-2000
95-70	20:23354	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016482	MF-606
DOE/RW–					
0425-Suppl.	20:23149	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013315	MF-815
0464	20:23187	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013657	MF-800
95014715	20:23327	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014715	MF-814
DOE/RW/00134–					
T17	20:23185	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013073	MF-814
T18	20:23326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013302	MF-820
T19	20:23186	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015529	MF-814
DOE/SF/17905–					
T10	20:23743	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014298	MF-504
DOE/SF/18852–					
T53	20:23558	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015363	MF-528
DOE/SF/19460–					
58	20:24858	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012914	MF-712
DOE/SF/19888–					
T1	20:23913	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015115	MF-1400
DOE/SF/20218–					
T2	20:23132	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014327	MF-510
DOE/SR/15199–					
7	20:23412	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014322	MF-700
DOE/SR/15048–					
4	20:24928	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014981	MF-700
DOE/SR/18159–					
4	20:24582	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014967	MF-702
DOE/SR/18217–					
4	20:23355	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012426	MF-600
DOE/WIPP–					
94-011	20:23188	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016694	MF-815
95-2072	20:23343	*See* DOE/CAO–2056-Vol.5-Draft			
DUN–					
4501	20:23597	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012652	MF-500
EGG–					
2458-Vol.5-Rev.4	20:23575	*See* NUREG/CR–4639-Vol.5-Rev.4			
EML–					
567	20:23189	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014966	MF-2000
ENEA-RT-AMB–					
92-26	20:23105	OSTI; NTIS (US Sales Only); INIS		DE95789727	
93-11	20:24629	OSTI; NTIS (US Sales Only)		DE95789709	
93-12	20:24533	OSTI; NTIS (US Sales Only)		DE95789710	
93-20	20:24583	OSTI; NTIS (US Sales Only)		DE95789705	
93-23	20:24384	OSTI; NTIS (US Sales Only)		DE95789706	
94-01	20:24630	OSTI; NTIS (US Sales Only)		DE95789707	
94-02	20:24719	OSTI; NTIS (US Sales Only)		DE95789728	
94-03	20:24631	OSTI; NTIS (US Sales Only)		DE95789708	
94-04	20:24632	OSTI; NTIS (US Sales Only)		DE95789713	
94-06	20:24633	OSTI; NTIS (US Sales Only)		DE95789712	
94-08	20:24732	OSTI; NTIS (US Sales Only)		DE95789711	
94-16	20:24634	OSTI; NTIS (US Sales Only)		DE95789740	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
94-18	20:24635	OSTI; NTIS (US Sales Only)		DE95789741	
94-19	20:24352	OSTI; NTIS (US Sales Only)		DE95789775	
94-21	20:24534	OSTI; NTIS (US Sales Only)		DE95789770	
94-22	20:24981	OSTI; NTIS (US Sales Only)		DE95789769	
94-27	20:23698	OSTI; NTIS (US Sales Only)		DE95789768	
94-30	20:24584	OSTI; NTIS (US Sales Only)		DE95789771	
94-35	20:24353	OSTI; NTIS (US Sales Only)		DE95789742	
ENEA-RT-ERG–					
94-21	20:24829	OSTI; NTIS (US Sales Only)		DE95789772	
95-02	20:23741	OSTI; NTIS (US Sales Only)		DE95789773	
ENEA-RT-ERG-FUS–					
94-29	20:24763	OSTI; NTIS (US Sales Only)		DE95789774	
95-06	20:23853	OSTI; NTIS (US Sales Only)		DE95789739	
ENEA-RT-INN–					
95-09	20:23616	OSTI; NTIS (US Sales Only)		DE95789754	
ENRESA–					
03/95	20:23190	OSTI; NTIS; INIS		DE95789657	
04/95	20:23191	OSTI; NTIS; INIS		DE95789656	
EPA–					
832-R-95-003	20:23805	*See* NREL/TP–430-7974			
ES/ER/TM–					
106	20:23356	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013998	MF-2070
112/R2	20:23357	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015374	MF-2000
ES/WM–					
30	20:23192	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012970	MF-2000
ESTSC–					
000805SPARC00	20:24982	ESTSC			
000895MLTPL00	20:24983	ESTSC			
001048IBMPC00	20:24984	ESTSC			
001050SUN0000	20:24985	ESTSC			
ETDE-BR–					
0001	20:23787	OSTI; NTIS (US Sales Only)		DE95789945	
0002	20:23638	OSTI; NTIS (US Sales Only)		DE95789946	
0003	20:23788	OSTI; NTIS (US Sales Only)		DE95789947	
0005	20:23483	OSTI; NTIS (US Sales Only)		DE95789949	
0006	20:23484	OSTI; NTIS (US Sales Only)		DE95789950	
0007	20:23469	OSTI; NTIS (US Sales Only)		DE95789951	
0008	20:23493	OSTI; NTIS (US Sales Only)		DE95789952	
0009	20:23733	OSTI; NTIS (US Sales Only)		DE95789953	
0010	20:23490	OSTI; NTIS (US Sales Only)		DE95789954	
0011	20:23470	OSTI; NTIS (US Sales Only)		DE95789955	
0012	20:23501	OSTI; NTIS (US Sales Only)		DE95789956	
0013	20:23789	OSTI; NTIS (US Sales Only)		DE95789957	
0014	20:23641	OSTI; NTIS (US Sales Only)		DE95789958	
0015	20:23734	OSTI; NTIS (US Sales Only)		DE95789959	
0016	20:23735	OSTI; NTIS (US Sales Only)		DE95789960	
0017	20:23047	OSTI; NTIS (US Sales Only)		DE95789961	
0018	20:23048	OSTI; NTIS (US Sales Only)		DE95789962	
0019	20:23721	OSTI; NTIS (US Sales Only)		DE95789963	
0020	20:23790	OSTI; NTIS (US Sales Only)		DE95789964	
0021	20:23791	OSTI; NTIS (US Sales Only)		DE95789965	
0022	20:23656	OSTI; NTIS (US Sales Only)		DE95789966	
0023	20:22999	OSTI; NTIS (US Sales Only)		DE95789967	
0024	20:23642	OSTI; NTIS (US Sales Only)		DE95789968	
0025	20:23643	OSTI; NTIS (US Sales Only)		DE95789969	
0026	20:23792	OSTI; NTIS (US Sales Only)		DE95789970	
ETDE-DE–					
108	20:23506	OSTI; NTIS (US Sales Only)		DE95778125	
109	20:23699	OSTI; NTIS (US Sales Only)		DE95778136	
137	20:23670	OSTI; NTIS (US Sales Only)		DE95790279	
138	20:23719	OSTI; NTIS (US Sales Only)		DE95790278	
139	20:23671	OSTI; NTIS (US Sales Only)		DE95790286	
140	20:23672	OSTI; NTIS (US Sales Only)		DE95790269	
141	20:23736	OSTI; NTIS (US Sales Only)		DE95790284	
143	20:23023	OSTI; NTIS (US Sales Only)		DE95791352	
145	20:24535	OSTI; NTIS (US Sales Only)		DE95790288	
146	20:24733	OSTI; NTIS (US Sales Only)		DE95791347	
147	20:24734	OSTI; NTIS (US Sales Only)		DE95791346	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
150	20:23755	OSTI; NTIS (US Sales Only)		DE95790709	
151	20:23485	OSTI; NTIS (US Sales Only)		DE95790557	
152	20:23491	OSTI; NTIS (US Sales Only)		DE95790893	
153	20:23049	OSTI; NTIS (US Sales Only)		DE95790758	
154	20:24653	OSTI; NTIS (US Sales Only)		DE95790379	
155	20:23424	OSTI; NTIS (US Sales Only)		DE95790380	
156	20:23425	OSTI; NTIS (US Sales Only)		DE95790252	
157	20:23737	OSTI; NTIS (US Sales Only)		DE95790731	
158	20:24585	OSTI; NTIS (US Sales Only)		DE95790216	
159	20:24536	OSTI; NTIS (US Sales Only)		DE95790221	
160	20:24537	OSTI; NTIS (US Sales Only)		DE95790908	
161	20:24538	OSTI; NTIS (US Sales Only)		DE95790970	
162	20:23504	OSTI; NTIS (US Sales Only)		DE95790274	
163	20:23793	OSTI; NTIS (US Sales Only)		DE95790270	
164	20:23756	OSTI; NTIS (US Sales Only)		DE95790281	
165	20:23492	OSTI; NTIS (US Sales Only)		DE95790276	
166	20:23486	OSTI; NTIS (US Sales Only)		DE95790277	
167	20:23766	OSTI; NTIS (US Sales Only)		DE95790272	
168	20:23757	OSTI; NTIS (US Sales Only)		DE95790560	
169	20:23487	OSTI; NTIS (US Sales Only)		DE95790555	
170	20:23024	OSTI; NTIS (US Sales Only)		DE95795752	
171	20:24735	OSTI; NTIS (US Sales Only)		DE95796015	
172	20:24539	OSTI; NTIS (US Sales Only)		DE95795715	
173	20:24540	OSTI; NTIS (US Sales Only)		DE95795758	
174	20:24636	OSTI; NTIS (US Sales Only)		DE95795754	
176	20:23700	OSTI; NTIS (US Sales Only)		DE95795828	
177	20:23124	OSTI; NTIS (US Sales Only)		DE95795824	
178	20:23106	OSTI; NTIS (US Sales Only)		DE95795825	
ETDE/CH-mf–					
95795488	20:23471	OSTI; NTIS		DE95795488	
ETDE/JP-mf–					
95790778	20:23432	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95790778	
95790784	20:23120	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95790784	
FEMP–					
2388	20:23358	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013793	MF-2020
FNAL–					
TM-1934	20:24986	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014550	MF-414
FNAL-TM–					
1937	20:24188	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014659	MF-414
1943	20:24355	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016647	MF-414
FNAL/C–					
177-E	20:24354	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015356	MF-414
95/046-E	20:24788	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013587	MF-414
95/064	20:24754	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013240	MF-412
95/096-E	20:24789	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014206	MF-414
95/103-E	20:24790	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013002	MF-414
95/109-E	20:24791	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014660	MF-414
95/115-E	20:24783	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013237	MF-414
95/117	20:24780	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014565	MF-414
95/118	20:24185	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014662	MF-414
95/143	20:24186	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014205	MF-406
95/144	20:24792	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014575	MF-414
95/150-E	20:24793	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014573	MF-414
95/161-E	20:24794	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014713	MF-414
95/170	20:24187	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014661	MF-414
95/171	20:24111	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014663	MF-414
FZKA–					
5521	20:24586	OSTI; NTIS (US Sales Only)		DE95795767	
5524	20:24541	OSTI; NTIS (US Sales Only)		DE95790228	
5529	20:24542	OSTI; NTIS (US Sales Only)		DE95795765	
5531	20:24443	OSTI; NTIS (US Sales Only)		DE95790089	
5549	20:24637	OSTI; NTIS (US Sales Only)		DE95790241	
5550	20:23854	OSTI; NTIS (US Sales Only); INIS		DE95795766	
5557	20:23855	OSTI; NTIS (US Sales Only); INIS		DE95795759	

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5582	20:23578	OSTI; NTIS (US Sales Only); INIS		DE95790240	
FZR–					
84	20:23617	OSTI; NTIS (US Sales Only); INIS		DE95795719	
FhG-IWM-W–					
2/95	20:23892	OSTI; NTIS (US Sales Only)		DE95795878	
GA-A–					
22048	20:24864	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015359	MF-420
22062	20:24865	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014669	MF-427
GAO/RCED–					
94-119	20:23828	OSTI; NTIS; INIS		DE95015118	
GFS–					
25/94	20:24587	OSTI; NTIS (US Sales Only); INIS		DE95795720	
GKSS–					
94/E/60	20:24028	OSTI; NTIS (US Sales Only)		DE95777844	
95/E/3	20:23856	OSTI; NTIS (US Sales Only)		DE95795736	
GRI–					
94/0227	20:23125	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015664	
GSF–					
4/95	20:24720	OSTI; NTIS (US Sales Only); INIS		DE95795657	
GSI–					
94-13	20:24888	OSTI; NTIS (US Sales Only); INIS		DE95796233	
HW–					
11321	20:23983	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014057	MF-500
19758	20:23133	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014047	MF-501
21195	20:23134	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014049	MF-500
24084	20:23135	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013931	MF-506
24514	20:23984	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013948	MF-507
24740	20:23136	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013936	MF-504
25042	20:23139	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015189	MF-500
25374	20:23985	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014106	MF-500
26450	20:23137	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014115	MF-526
3-236	20:23598	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012706	MF-500
41274	20:23385	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014055	MF-500
54559	20:23599	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013925	MF-500
56696	20:24356	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014113	MF-507
59743	20:23138	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014063	MF-517
IAEA-TECDOC–					
793	20:23701	OSTI; NTIS (US Sales Only); INIS		DE95631168	
IFSR–					
701	20:24863	*See* DOE/ET/53088–701			
IKE–					
2-110	20:23618	OSTI; NTIS (US Sales Only); INIS		DE95795737	
INIS-BR–					
3504	20:23020	OSTI; NTIS (US Sales Only); INIS		DE95633429	
INIS-JP–					
037	20:24060	OSTI; NTIS; INIS		DE95789433	
INIS-mf–					
14542	20:24638	OSTI; NTIS (US Sales Only); INIS		DE95632316	
14544	20:24987	OSTI; NTIS (US Sales Only); INIS		DE95632489	
14545	20:23405	OSTI; NTIS (US Sales Only); INIS		DE95632407	
14546	20:24988	OSTI; NTIS (US Sales Only); INIS		DE95632490	
14547	20:24989	OSTI; NTIS (US Sales Only); INIS		DE95632491	
15115	20:24889	OSTI; NTIS (US Sales Only); INIS		DE95790263	
15116	20:23738	OSTI; NTIS (US Sales Only); INIS		DE95790214	
INS–					
1079	20:24808	OSTI; NTIS; INIS		DE95789263	
1081	20:24809	OSTI; NTIS; INIS		DE95789264	
ISPO–					
378	20:23391	*See* PNL-SA–26411			
378-App.A	20:23392	*See* PNL-SA–26411-App.A			
378-App.B	20:23393	*See* PNL-SA–26411-App.B			
ISTISAN–					
94-15	20:24543	OSTI; NTIS (US Sales Only)		DE95771028	
ITRI–					
145	20:24588	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014378	MF-630
JAERI-Data/Code–					
95-001	20:24990	OSTI; NTIS; INIS		DE95789303	
95-002	20:24721	OSTI; NTIS; INIS		DE95789319	
JAERI-Research–					
94-040	20:24544	OSTI; NTIS; INIS		DE95789462	
95-008	20:23579	OSTI; NTIS; INIS		DE95789260	

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JAERI-Research–					
95-010	20:24817	OSTI; NTIS; INIS		DE95789301	
95-017	20:24890	OSTI; NTIS; INIS		DE95789316	
95-018	20:24891	OSTI; NTIS; INIS		DE95789304	
95-023	20:24892	OSTI; NTIS; INIS		DE95789320	
95-027	20:23540	OSTI; NTIS; INIS		DE95789390	
95-030	20:23140	OSTI; NTIS; INIS		DE95789391	
95-031	20:23857	OSTI; NTIS; INIS		DE95789321	
95-032	20:23858	OSTI; NTIS; INIS		DE95789322	
JAERI-Review–					
95-002	20:24937	OSTI; NTIS; INIS		DE95789323	
95-003	20:24866	OSTI; NTIS; INIS		DE95789285	
95-004	20:23552	OSTI; NTIS; INIS		DE95789252	
95-005	20:23600	OSTI; NTIS; INIS		DE95789318	
95-009	20:23193	OSTI; NTIS; INIS		DE95789395	
JAERI-Tech–					
94-032	20:24589	OSTI; NTIS; INIS		DE95789466	
95-002	20:23601	OSTI; NTIS; INIS		DE95789261	
95-006	20:24893	OSTI; NTIS; INIS		DE95789283	
95-007	20:23914	OSTI; NTIS; INIS		DE95789253	
95-008	20:24894	OSTI; NTIS; INIS		DE95789284	
95-009	20:23893	OSTI; NTIS; INIS		DE95789300	
95-011	20:24895	OSTI; NTIS; INIS		DE95789314	
95-013	20:23407	OSTI; NTIS; INIS		DE95789344	
95-014	20:24991	OSTI; NTIS; INIS		DE95789299	
95-016	20:23141	OSTI; NTIS; INIS		DE95789324	
95-017	20:23859	OSTI; NTIS; INIS		DE95789298	
95-018	20:24896	OSTI; NTIS; INIS		DE95789345	
95-020	20:23602	OSTI; NTIS; INIS		DE95789302	
95-021	20:24897	OSTI; NTIS; INIS		DE95789313	
95-022	20:24898	OSTI; NTIS; INIS		DE95789325	
95-023	20:23603	OSTI; NTIS; INIS		DE95789317	
95-024	20:23142	OSTI; NTIS; INIS		DE95789392	
95-027	20:23143	OSTI; NTIS; INIS		DE95789315	
95-028	20:24899	OSTI; NTIS; INIS		DE95789343	
95-029	20:23144	OSTI; NTIS; INIS		DE95789347	
JINR-D–					
13-92-581	20:24357	OSTI; NTIS (US Sales Only); INIS		DE95633648	
9-92-455	20:24066	OSTI; NTIS (US Sales Only); INIS		DE95633506	
JINR-E–					
4-94-123	20:24804	OSTI; NTIS (US Sales Only); INIS		DE95633649	
JINR-R–					
2-94-150	20:24764	OSTI; NTIS (US Sales Only); INIS		DE95633241	
Juel–					
2928	20:23585	OSTI; NTIS (US Sales Only); INIS		DE95791275	
K/NSP–					
274	20:24590	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011838	MF-902
275	20:24591	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95010929	MF-2000
KCP–					
613-5430	20:24429	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014898	MF-706
613-5536	20:24430	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014897	MF-706
613-5570	20:23986	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013996	MF-706
613-5587	20:23794	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010188	MF-706
KFK–					
5351	20:23194	OSTI; NTIS (US Sales Only); INIS		DE95796284	
5359	20:23536	OSTI; NTIS (US Sales Only); INIS		DE95791198	
KURRI-TR–					
388	20:24369	OSTI; NTIS; INIS		DE95789430	
393	20:23945	OSTI; NTIS; INIS		DE95789432	
LA–					
12824-MS	20:23207	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015063	MF-802
12901-PR	20:24037	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012120	MF-700
12954-MS	20:23208	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015051	MF-2000
12967-MS	20:23328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015053	MF-2000
12971-SR	20:24736	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015054	MF-902
12981-MS	20:24722	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016704	MF-940
13014-H	20:24415	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016705	MF-741
LA-SUB–					
94-161	20:23946	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011841	MF-721

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
95-27-3	20:24592	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013054	MF-2000
95-36-Vol.1	20:24938	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013476	MF-814
95-36-Vol.2	20:23209	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013477	MF-814
95-59	20:24746	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012956	MF-903
95-61	20:24747	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012957	MF-903
95-62	20:24748	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012958	MF-903
95-69	20:24755	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012959	MF-703
95-72	20:23329	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014570	MF-402
95-73	20:23210	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014568	MF-814
95-77	20:24996	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014566	MF-405
95-88	20:24765	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014567	MF-910
95-90	20:24834	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014571	MF-910
95-93	20:24593	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014560	MF-2070
95-98	20:24545	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015247	MF-402
LA-UR–					
93-3564	20:23619	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014572	
95-1169	20:24997	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010882	MF-405
95-1223	20:24998	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012077	MF-705
95-1245	20:23915	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012076	MF-704
95-1267	20:23359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014017	MF-700
95-1304	20:23961	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012074	MF-701
95-1324	20:23894	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012070	MF-1391
95-1342	20:23330	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014014	MF-902; MF-940
95-1351	20:23746	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012063	MF-1500
95-1352	20:23747	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012064	MF-1500
95-1383	20:23559	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014013	
95-1385	20:24235	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014012	MF-414
95-1386	20:24236	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014011	MF-414
95-1390	20:23360	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012055	MF-721
95-1439	20:24902	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014010	MF-712
95-1463	20:23916	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010986	MF-1425
95-1464	20:23917	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011998	MF-1425
95-1466	20:23415	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011997	MF-706
95-1489	20:24785	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011993	MF-910
95-1520	20:23918	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011985	MF-1425
95-1539	20:24759	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011982	
95-1549	20:24130	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011977	MF-414
95-1567	20:24131	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011972	MF-414
95-1568	20:24132	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011971	MF-414
95-1594	20:23620	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015287	
95-1641	20:23767	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015335	
95-1838	20:23211	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015256	MF-2020
95-1940	20:23860	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015277	MF-404
95-741	20:23095	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007831	MF-702
LBF-TB–					
200(1994)	20:23861	OSTI; NTIS (US Sales Only)		DE95796279	
LBL–					
35890	20:24328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014787	MF-414
36370	20:24825	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011279	MF-413
36400	20:24594	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015144	MF-400
36459	20:24237	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014870	MF-414
36465	20:23962	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014770	MF-411
36487	20:24903	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014782	MF-414
36499	20:24800	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014869	MF-414
36537	20:24756	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95006572	MF-414
36565	20:24090	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014836	MF-410; MF-406
37040	20:23212	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014872	MF-802
37045	20:24335	*See* SLAC-PUB–95-6812			
37170	20:23963	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014799	MF-401
37201	20:24826	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014871	MF-413

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
37206	20:24999	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014792	MF-405; MF-410
37222	20:23445	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015141	MF-109
37250	20:24336	*See* SLAC-PUB–95-6897			
37254	20:24811	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014769	MF-413
37332	20:23213	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015139	MF-814
37337	20:23214	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015137	MF-2010
37379	20:23919	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016457	MF-404
LBL-PUB–					
5409	20:24939	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011277	MF-400
LNF-IR–					
95-014	20:24040	OSTI; NTIS (US Sales Only)		DE95789749	
95-017	20:24723	OSTI; NTIS (US Sales Only)		DE95789748	
LNF-P–					
95-010	20:24768	OSTI; NTIS (US Sales Only)		DE95789750	
95-013	20:23864	OSTI; NTIS (US Sales Only)		DE95789752	
95-015	20:24812	OSTI; NTIS (US Sales Only)		DE95789753	
95-016	20:24133	OSTI; NTIS (US Sales Only)		DE95789751	
LS–					
109	20:24329	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015571	MF-414
155	20:24330	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015572	MF-414
160	20:24250	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015500	MF-411
165	20:24830	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015216	MF-414; MF-411
166	20:24251	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015217	MF-414; MF-411
167	20:24252	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015231	MF-414; MF-411
168	20:24253	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015230	MF-414
171	20:24254	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015227	MF-414; MF-411
172	20:24255	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015226	MF-414; MF-411
173(ANL)	20:24256	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015545	MF-411
177	20:24331	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015497	MF-411
181	20:24257	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015207	MF-414; MF-411
183	20:24134	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015398	MF-414; MF-411
185	20:24258	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015399	MF-414; MF-411
186	20:24259	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015400	MF-414; MF-411
189	20:24332	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015203	MF-414; MF-411
190	20:24260	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015223	MF-414; MF-411
191	20:24091	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015224	MF-414; MF-411
193	20:24261	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015222	MF-414; MF-411
196	20:24135	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015220	MF-414; MF-411
197	20:24262	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015221	MF-414; MF-411
200	20:24263	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015564	MF-411
203	20:24264	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015206	MF-414; MF-411
204	20:24265	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015205	MF-414; MF-411
205	20:24266	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015390	MF-414; MF-411
207	20:24267	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015389	MF-414; MF-411
208	20:24268	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015388	MF-414; MF-411
209	20:24269	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015387	MF-414; MF-411
213	20:24136	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015568	MF-414
214	20:24333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015393	MF-414; MF-411

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215	20:24270	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015392	MF-414; MF-411
216	20:24271	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015391	MF-414; MF-411
220	20:24334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015211	MF-414; MF-411
225	20:24272	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015233	MF-414; MF-411
231	20:24137	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015204	MF-414; MF-411
232	20:24273	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015234	MF-414; MF-411
233	20:24274	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015232	MF-414; MF-411
235	20:24275	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015213	MF-414; MF-411
238	20:24276	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015212	MF-414; MF-411
239	20:24277	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015214	MF-414; MF-411
240	20:24278	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015215	MF-414; MF-411
243	20:24279	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015822	MF-414; MF-411
MMSC-EM–					
95011	20:23361	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014021	MF-2000
MTR–					
94W0000114-Vol.1	20:23632	*See* NUREG/CR–6263-Vol.1			
NCRP–					
95-22246	20:23215	OSTI; NTIS; INIS; NCRP Publications, 7910 Woodmont Avenue, Suite 800, Bethesda, MD 20814-3095; GPO Dep.	E 1.99:	DE95016101	MF-2000
NEDO-C–					
9201	20:23021	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95790774	
9301	20:22978	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95790769	
9332	20:23022	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95790787	
NEDO-OS–					
9401	20:23713	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE95790767	
NIFS–					
329	20:24867	OSTI; NTIS; INIS		DE95789307	
330	20:24868	OSTI; NTIS; INIS		DE95789308	
331	20:24869	OSTI; NTIS; INIS		DE95789312	
332	20:24870	OSTI; NTIS; INIS		DE95789306	
333	20:24871	OSTI; NTIS; INIS		DE95789309	
334	20:24872	OSTI; NTIS; INIS		DE95789310	
335	20:24873	OSTI; NTIS; INIS		DE95789311	
NREL/SP–					
463-7668	20:23472	OSTI; NTIS; GPO Dep.	E 1.99:	DE95004064	MF-920
NREL/TP–					
410-7993	20:23473	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009244	PC-1250
411-8005	20:23474	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009221	MF-1270
411-8019	20:23475	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009235	MF-1262
413-8121	20:23476	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009257	MF-1264
425-6550	20:23820	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006893	MF-1504

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NREL/TP–					
425-7518	20:23821	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009224	MF-1504
425-7618	20:23822	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009250	MF-1504
425-7629	20:23823	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009231	MF-1504
430-7974	20:23805	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009216	MF-1414
430-7976	20:23806	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009219	MF-1414
431-7971	20:23426	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009245	MF-1312
433-7965	20:23428	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009212	MF-1310
441-7808	20:23507	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009211	MF-1213
441-7821	20:23505	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009220	MF-1210
442-7110	20:23508	OSTI; NTIS, GPO Dep.	E 1.99:	DE95009251	MF-1213
442-7812	20:23509	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009252	MF-1213
442-7813	20:23510	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009260	MF-1213
451-8101	20:23477	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009238	MF-1262
451-8117	20:23478	OSTI; NTIS; GPO Dep.	E 1.99:	DE95009263	MF-1263
NSA–					
95-1	20:24138	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013448	MF-411
95-2	20:24139	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013447	MF-411
95-3	20:24140	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013449	MF-411
95-4	20:24141	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013446	MF-411
NUREG–					
0090-Vol.18-No.1	20:23409	OSTI; NTIS; INIS; GPO		TI95015357	
0750-Vol.41-Index-1	20:23560	OSTI; NTIS; GPO; INIS		TI95014670	
0750-Vol.41-No.3	20:23561	OSTI; NTIS; GPO; INIS		TI95012815	
0750-Vol.41-No.4	20:23537	OSTI; NTIS; GPO; INIS		TI95014355	
0837-Vol.15-No.1	20:24595	OSTI; NTIS; GPO; INIS		TI95012817	
0847-Suppl.-No.15	20:23621	OSTI; NTIS; GPO; INIS		TI95014755	
0940-Vol.14-No.1-Pt.1	20:23562	OSTI; NTIS; GPO; INIS		TI95012819	
1430-Vol.1-Rev.1	20:23548	OSTI; NTIS; INIS; GPO		TI95013599	
1430-Vol.3-Rev.1	20:23622	OSTI; NTIS; INIS		TI95013649	
1431-Vol.1-Rev.1	20:23549	OSTI; NTIS; GPO; INIS		TI95014293	
1431-Vol.2-Rev.1	20:23550	OSTI; NTIS; GPO; INIS		TI95014294	
1431-Vol.3-Rev.1	20:23551	OSTI; NTIS; GPO; INIS		TI95014295	
1432-Vol.1-Rev.1	20:23623	OSTI; NTIS; INIS; GPO		TI95013541	
1432-Vol.2-Rev.1	20:23541	OSTI; NTIS; INIS; GPO		TI95013535	
1432-Vol.3-Rev.1	20:23624	OSTI; NTIS; INIS; GPO		TI95013598	
1433-Vol.1-Rev.1	20:23625	OSTI; NTIS; INIS; GPO		TI95013540	
1478-Rev.1	20:23563	OSTI; NTIS; GPO; INIS		TI95014362	
1526	20:23626	OSTI; NTIS; GPO; INIS		TI95014359	
1527	20:23542	OSTI; NTIS; INIS; GPO		TI95014076	
NUREG/CP–					
0141	20:23587	OSTI; NTIS; GPO; INIS		TI95007828	MF-602
NUREG/CR–					
4639-Vol.5-Rev.4	20:23575	OSTI; NTIS; GPO; INIS		TI95014436	
5857	20:23627	OSTI; NTIS; GPO; INIS		TI95014753	
5954	20:23628	OSTI; NTIS; GPO; INIS		TI95014434	
6125-Vol.1	20:24702	OSTI; NTIS; GPO; INIS		TI95012811	
6144-Vol.6-Pt.1	20:23588	OSTI; NTIS; GPO; INIS		TI95013650	
6144-Vol.6-Pt.2	20:23629	OSTI; NTIS; GPO; INIS		TI95014377	
6174-Vol.1	20:23630	OSTI; NTIS; GPO; INIS		TI95013056	
6174-Vol.2	20:23631	OSTI; NTIS; GPO; INIS		TI95013057	
6263-Vol.1	20:23632	OSTI; NTIS; INIS; GPO		TI95015163	
6270	20:23633	OSTI; NTIS; GPO; INIS		TI95013055	
6307	20:23723	OSTI; NTIS; GPO; INIS		TI95014754	
6330	20:23724	OSTI; NTIS; GPO; INIS		TI95014361	
NYSERDA–					
95-9	20:23427	OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223 (United States)		TI95014549	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
95-10	20:23758	OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223 (United States)		TI95014543	
OCDO–					
95012719	20:23525	OSTI; Ohio Coal Development Office, 77 S. High Street, P.O. Box 1001, Columbus, OH 43266-0001 (United States)		TI95012719	
ORISE–					
93/J-42	20:23362	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013655	MF-407
94/G-34	20:24724	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013844	MF-407
95/B-22	20:24725	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015624	MF-407; MF-408
ORNL–					
6713	20:23627	*See* NUREG/CR–5857			
6804/R1	20:23657	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013967	MF-1372
6817	20:23991	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014466	MF-406
6858	20:23431	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011623	MF-1310
ORNL/CON–					
412	20:23759	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012543	MF-1600
ORNL/ER–					
230	20:23410	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008963	MF-2050
294	20:23216	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014002	MF-2010
ORNL/M–					
3563	20:23604	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013507	MF-500
3738	20:23605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016131	MF-413
3774	20:23408	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012535	MF-413
3993	20:23606	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012539	MF-413
4090	20:23192	*See* ES/WM–30			
4316	20:25000	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013791	MF-406
4464	20:24887	*See* DOE-STD–0028-95			
ORNL/MD/LTR–					
13	20:23386	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011767	MF-404
ORNL/RASA–					
94/3	20:23363	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012542	MF-2070
95/10	20:24602	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014474	MF-902
95/11	20:24603	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014475	MF-902
95/3	20:23364	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014467	MF-511
95/4	20:24596	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014468	MF-511
95/5	20:24597	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014469	MF-511
95/6	20:24598	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014470	MF-902
95/7	20:24599	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014471	MF-902
95/8	20:24600	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014472	MF-902
95/9	20:24601	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014473	MF-902
ORNL/SUB–					
87-SB154/03	20:23865	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013450	MF-114
91-SH225	20:23760	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011624	MF-1416
ORNL/TM–					
12374	20:23992	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016201	MF-707
12732	20:23993	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014486	MF-406
12784	20:23217	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011630	MF-2030
12813-Pt.2	20:23994	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014899	MF-406
12861	20:24546	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014068	MF-1240
12863	20:23496	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014186	MF-1310
12902	20:23714	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013968	MF-1505
12905	20:23795	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011629	
12913	20:23218	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014460	MF-2020
12919	20:23219	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012501	MF-402
12935	20:23220	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012546	MF-2000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ORNL/TM–					
12938	20:23221	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013798	MF-2030
12965	20:24703	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013506	MF-408
12978	20:24385	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013508	MF-406
12979	20:23387	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014465	MF-940
12988	20:25001	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014464	
13007	20:23222	OSTI; NTIS; INIS		TI95013966	
13012	20:23150	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014488	MF-2000
13031	20:23702	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016398	
13034	20:23223	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008645	MF-2000
PATENTS-US–					
A8042209	20:24857	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015104	MF-704
A8056390	20:24386	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015102	MF-706
A8058844	20:24387	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015101	MF-706
A8058850	20:24399	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015050	MF-506
A8062512	20:24604	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015048	MF-721
A8064880	20:23995	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015045	MF-706
A8064887	20:24400	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015049	MF-706
A8066235	20:24371	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015047	MF-706
A8066236	20:24401	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015046	MF-706; MF-702
A8067912	20:24388	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015043	MF-706
A8067914	20:23576	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015042	MF-506
A8067967	20:24905	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015040	MF-406
A8068032	20:23996	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015039	MF-706
A8070196	20:24712	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE95015037	MF-706
PNL–					
10086	20:23633	*See* NUREG/CR–6270			
10360	20:23225	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014506	MF-2030
10454	20:23107	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95008897	MF-902
10460	20:23226	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011683	MF-2030
10500-Pt.2	20:24547	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015264	MF-402
10519-2	20:23715	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015136	MF-900
10522	20:23227	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011869	MF-2010
10541	20:23761	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015135	MF-1600
10546	20:23796	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011871	MF-1416
10548	20:23724	*See* NUREG/CR–6330			
10562	20:23921	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012941	MF-900
10589	20:23228	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015134	MF-2030
10592	20:23807	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014185	MF-500
10600	20:23229	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015594	MF-812
10608	20:24605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015593	MF-2000
10614	20:24726	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015592	MF-607
10620	20:23411	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015815	MF-2000
10627	20:24639	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015196	MF-630
10630	20:23511	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015265	MF-1211
10633	20:24606	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015839	MF-2020
10637	20:23365	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015443	MF-2030
8040	20:23224	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015838	MF-510
9975-Vol.1	20:23630	*See* NUREG/CR–6174-Vol.1			
9975-Vol.2	20:23631	*See* NUREG/CR–6174-Vol.2			
PNL-D–					
376	20:23388	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012666	MF-500
405	20:23389	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012668	MF-500
PNL-SA–					
23600	20:25002	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015802	MF-2000
23817	20:23390	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014626	MF-900

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
23964	20:25029	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011497	MF-900
24280	20:23366	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014625	MF-2010
24295	20:23429	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014616	MF-401
24715	20:25003	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014622	MF-405
24720	20:23230	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014639	MF-2000
24733	20:23997	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014609	
24794	20:23964	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014627	MF-401
24972	20:25004	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014173	MF-2000
24982	20:23231	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014167	MF-810
25190	20:23663	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014187	MF-1220
25597	20:23998	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014608	MF-406
25632	20:24548	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014193	MF-402
25640	20:24607	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014168	MF-2080
25678	20:24608	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014194	MF-2010
25679	20:24609	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014195	MF-2010
25715	20:25005	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014196	MF-405
25753	20:23232	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014171	MF-2020
25764	20:23233	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014190	MF-2020
25889	20:23658	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014192	MF-1394
25942	20:23703	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014617	MF-1600
25944	20:23797	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014629	MF-1414
25948	20:23704	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014628	MF-2000
25949	20:24549	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014612	MF-402
26005	20:23762	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014610	MF-400
26069	20:24708	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014634	MF-408
26071	20:23234	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014169	MF-2030
26072	20:25006	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014607	MF-405
26086	20:25007	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014613	
26103	20:24389	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014633	MF-406
26104	20:24372	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014632	MF-906
26111	20:23235	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014198	MF-2030
26129	20:23705	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014631	
26147	20:23236	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014635	MF-2000
26159	20:23706	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014621	MF-402
26161	20:23999	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014614	MF-2060
26209	20:23331	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014620	MF-814
26254	20:24390	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014174	MF-406
26258	20:24705	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014637	MF-2010
26269	20:24727	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014172	MF-408
26298	20:23895	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014170	MF-114
26327	20:23683	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014630	MF-400
26411	20:23391	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015179	MF-515
26411-App.A	20:23392	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015180	MF-515
26411-App.B	20:23393	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015181	MF-515
26451	20:23896	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014623	MF-404
POEF-SH–					
31	20:23130	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014999	MF-610
PPPL–					
3011-R	20:24874	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016245	PC-420; PC-422; PC-426
3114	20:24875	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016239	PC-420
3116	20:24876	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016240	PC-420

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PPPL–					
3120	20:24877	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016241	PC-420
PSC–					
39	20:24878	OSTI; NTIS; INIS		DE95789262	
RFP–					
4902	20:24940	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014003	MF-700
4969	20:23367	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014665	MF-707
4971	20:23368	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014671	MF-702; MF-707
4972	20:24550	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014672	MF-702; MF-707
4973	20:23394	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015352	MF-2030
SAND–					
78-1596-Vol.1	20:23319	*See* DOE/CAO–2056-Vol.6-Draft			
78-1596-Vol.2	20:23320	*See* DOE/CAO–2056-Vol.7-Draft			
90-2318	20:23668	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013871	MF-701
92-1449	20:23488	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015440	MF-1302
93-0499	20:24769	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95007716	MF-700; MF-706
93-3918C	20:24906	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013025	MF-421
94-0323C	20:24610	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014216	MF-802; MF-814
94-0340	20:23922	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013556	MF-704
94-0379	20:23237	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013836	MF-814
94-1527	20:23684	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013872	MF-900
94-1735	20:24770	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012525	MF-705
94-1911	20:24142	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010334	MF-706
94-1945	20:23716	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015057	MF-2000
94-1946	20:23717	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015058	MF-2000
94-2328/1	20:24941	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014530	MF-600
94-2328/2	20:23768	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014528	MF-600
94-2468C	20:24852	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014603	MF-406
94-2585	20:23332	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014138	MF-814
94-2593C	20:24041	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011599	MF-704
94-2611	20:23369	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015010	MF-2000
94-2814C	20:24431	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011878	MF-706
94-2875	20:24410	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014129	MF-906
94-3124	20:25008	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011832	MF-705
94-3151C	20:23395	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013859	MF-706
94-3244C	20:23923	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013032	MF-704
95-0008C	20:24031	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014994	MF-706
95-0222C	20:23067	OSTI; NTIS; GPO Dep.	E 1.99:	DE95008505	MF-126
95-0226C	20:25030	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007739	MF-705
95-0328C	20:24942	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007737	MF-705
95-0336C	20:25031	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013555	MF-800
95-0347C	20:24740	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007738	MF-707
95-0348C	20:24929	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007740	MF-700
95-0388	20:23965	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012522	MF-701
95-0488/1	20:23238	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015011	MF-814
95-0488/2	20:23239	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015013	MF-814
95-0776	20:23240	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013856	MF-602
95-0798	20:24435	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013035	MF-705
95-0833C	20:23924	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011896	
95-0841C	20:23866	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014605	MF-701
95-0845	20:24943	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012529	MF-900
95-0849C	20:24000	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011888	MF-2060
95-0867	20:23769	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013558	MF-1500
95-0869C	20:23925	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013866	MF-704
95-0908C	20:24944	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013887	MF-900
95-0913	20:24042	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013885	MF-706
95-0933C	20:23926	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012226	
95-0935C	20:24001	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011884	MF-706
95-0937	20:24945	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015439	MF-707
95-0942C	20:24946	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014853	MF-700
95-0968C	20:24416	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011877	MF-742

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
95-1035C	20:23634	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013029	MF-700
95-1036C	20:23635	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013028	MF-700
95-1040	20:24043	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014490	MF-706
95-1063	20:23966	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014491	MF-403
95-1065	20:25032	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014492	MF-630
95-1084C	20:24611	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013027	MF-2000
95-1106	20:23489	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013030	MF-235
95-1107C	20:23607	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013031	MF-700
95-1124C	20:23000	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013034	MF-108
95-1125C	20:23815	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013017	MF-706
95-1165C	20:24044	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013830	MF-706
95-1168C	20:25033	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013863	MF-705
95-1189C	20:24022	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013862	MF-706
95-1195C	20:24002	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013864	MF-706
95-1196C	20:24023	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013860	MF-705
95-1201	20:24849	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015062	MF-410
95-1232C	20:24831	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013831	MF-700
95-1235C	20:24003	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013868	MF-705
95-1236	20:23241	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014532	MF-2000
95-1239C	20:24832	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013832	MF-700
95-1245C	20:23396	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014214	MF-940
95-1251C	20:23685	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014601	MF-2000
95-1253C	20:23397	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014215	MF-900
95-1268	20:23770	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014531	MF-1500
95-1272C	20:24004	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014604	MF-706
95-1273C	20:23398	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014212	MF-900
95-1287C	20:23867	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014602	MF-704; MF-705
95-1289C	20:23497	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014851	MF-1243
95-1290C	20:23927	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014217	MF-704
95-1291C	20:23928	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014606	MF-704
95-1304	20:23370	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015407	MF-607
95-1306C	20:24391	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014218	MF-706
95-1313C	20:23669	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014859	MF-701
95-1320	20:23929	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015061	MF-705
95-1338C	20:24827	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014866	MF-705
95-1361	20:23636	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015733	MF-610
95-1364C	20:24432	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014861	MF-706; MF-705
95-1374C	20:24045	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014863	MF-706; MF-704
95-1425C	20:24046	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014860	MF-704
95-1434/2	20:23707	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015734	MF-900
95-1441C	20:23399	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014858	MF-706
95-8227	20:24417	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015266	MF-721
95-8234	20:23043	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015267	MF-1409
95-8235	20:24418	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015268	MF-721
95-8247	20:23664	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014489	MF-406
95-8248	20:24419	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015840	MF-742
95-8250	20:23044	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015841	MF-104
95-8251	20:23045	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015842	MF-104
95-8252	20:23046	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015843	MF-1409
95-8497C	20:23973	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010754	MF-405
95-8502C	20:23868	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010759	MF-404
95-8513C	20:23869	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010699	MF-404
95-8525C	20:23870	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010755	MF-404
95-8531	20:23974	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014027	MF-900
95-8534C	20:23871	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010763	MF-404
95-8550C	20:24047	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010753	MF-406
95-8562C	20:23810	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010760	MF-1412
95-8564C	20:24005	OSTI; NTIS; GPO Dep.	E 1.99:	DE95010762	MF-405
95-8569	20:23967	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015377	MF-401
95-8591	20:24749	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011338	MF-412

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
95-8615C	20:23242	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014354	MF-702
95-8649C	20:23400	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014352	MF-700
SLAC-PUB–					
95-6684	20:24143	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013398	MF-414
95-6791	20:24144	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014655	MF-414
95-6802	20:24145	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014648	MF-414
95-6806	20:24146	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014542	MF-414
95-6812	20:24335	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014650	MF-414
95-6825	20:24092	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013423	MF-414
95-6840	20:24147	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013378	MF-414
95-6879	20:24280	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013281	MF-414
95-6894	20:24281	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013397	MF-414
95-6897	20:24336	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013377	MF-414
95-6901	20:24337	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013369	MF-414
95-6902	20:24338	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013376	MF-414
95-6906	20:24282	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013283	MF-414
95-6907	20:24283	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013284	MF-414
95-6908	20:24284	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013285	MF-414
SLAC-R–					
95-464	20:25009	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016261	PC-405
SREL–					
49	20:24737	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015348	MF-505
50	20:25010	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015347	MF-505
SSC–					
100-Rev.A	20:24285	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011223	MF-414
SSC-SR–					
1002	20:24096	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011066	MF-414
1003	20:24097	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011067	MF-414
1004	20:24296	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011068	MF-414
1005	20:24098	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011069	MF-414
1008	20:24099	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011072	MF-414
1010	20:24297	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011074	MF-414
1011	20:24100	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011075	MF-414
1021	20:24374	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011083	MF-414
1025	20:24298	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011087	MF-414
SSCL–					
463	20:24802	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011150	MF-414
564	20:24148	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011201	MF-414
640	20:24149	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011183	MF-414
671	20:24286	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011189	MF-414
675	20:24093	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011192	MF-410; MF-405
SSCL-Preprint–					
212	20:24287	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011193	MF-414
221	20:24288	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011194	MF-414
270	20:24289	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011196	MF-414
430	20:24290	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011198	MF-414
462	20:24291	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011134	MF-414
496	20:24786	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011202	MF-414
507	20:24094	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011788	MF-403; MF-414
513	20:24150	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011219	MF-414
519	20:24151	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011217	MF-414
540	20:24292	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011204	MF-414; MF-405
542	20:24777	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011152	MF-414
550	20:24152	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011033	MF-414
552	20:24778	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011155	MF-414
553	20:24373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011156	MF-414
555	20:24293	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011034	MF-414
556	20:24294	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011035	MF-414
558	20:24095	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011037	MF-414
SSCL-SR–					
1173	20:24779	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011027	MF-414
1211	20:24295	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011164	MF-414
1217	20:24947	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011209	MF-402; MF-414
1218	20:24803	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011203	MF-414
UBA-FB–					
93-077/1	20:24733	*See* ETDE-DE–146			
93-077/2	20:24734	*See* ETDE-DE–147			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
UCB-PTH–					
94/35	20:24756	*See* LBL–36537			
UCRL–					
52000-95-4	20:24907	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015109	PC-700
JC-120672	20:24013	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012455	MF-705; MF-706
UCRL-CR–					
119635	20:24392	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014123	MF-712
120302-Pt.2	20:24908	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013269	MF-900
120462	20:25011	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013275	MF-705
UCRL-ID–					
106132-Rev.1	20:24612	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014137	MF-702
106454-94-4	20:23401	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012472	MF-700
114972-2	20:23718	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014118	MF-400
116187-94-9	20:23243	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014136	MF-702
116187-94-10	20:24948	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013308	MF-902
116187-95-4	20:23244	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014397	MF-702
116187-95-5	20:23245	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015416	MF-702
118502	20:24048	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015378	MF-700
118528	20:24909	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011765	MF-712
118533	20:24640	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015379	MF-700
118561	20:23246	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015026	MF-2070; MF-2030
118655	20:23968	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015844	MF-904
118664	20:23872	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015845	MF-704
118749	20:24049	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011758	MF-906
119072	20:24879	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014381	MF-906
119089	20:23873	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014372	MF-900
119107	20:24910	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015421	MF-700
119252	20:24420	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015846	MF-704
119254	20:24393	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015847	MF-904
119263	20:23969	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015848	MF-904
119352-Pt.1	20:24750	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015381	MF-700
119535	20:24402	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015425	MF-700
119535-1	20:24403	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015426	MF-700
119675	20:24421	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015973	MF-904
119720-Add.1	20:23247	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013430	MF-902
119734	20:25012	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014673	MF-703; MF-705
119832	20:23930	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015128	MF-810
119932	20:24911	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015383	MF-712
120121	20:24751	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014380	MF-505
120159	20:24880	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012259	MF-900
120162	20:23931	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013917	MF-704
120168	20:24397	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015849	MF-900
120260	20:24404	OSTI; NTIS; GPO Dep.	E 1.99:	DE95016047	MF-903
120286	20:24375	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015417	MF-706
120296	20:23808	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015132	MF-900
120307	20:24376	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015850	MF-700
120321	20:24613	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015131	MF-703; MF-702
120322	20:24614	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015130	MF-903; MF-902
120373	20:23874	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015951	MF-704
120484	20:25013	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015129	MF-705
120485	20:25014	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015105	MF-705
120543	20:23661	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011518	MF-700
120683	20:23248	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015034	MF-721
120740	20:24709	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011698	MF-908
120746	20:24771	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013248	MF-910
120913	20:24912	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014515	MF-712
120930	20:24029	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014164	MF-706
120947	20:23830	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015126	MF-702
121006	20:23402	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015952	MF-700
121036	20:24433	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014514	MF-741
121067	20:23708	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013918	MF-902
121228	20:24434	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015985	MF-703
121339	20:24913	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015975	MF-712
121357	20:23771	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015595	MF-900

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
121571	20:24377	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015976	MF-414
UCRL-JC--					
115959	20:24850	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014698	MF-712
116437-Rev.1	20:24752	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013262	MF-903
116524	20:24753	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014513	MF-903
117006	20:24050	OSTI; NTIS; GPO Dep.	E 1.99:	DE95015031	MF-706
117020	20:24835	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014697	MF-712
117302	20:24914	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014166	MF-712
117332	20:24915	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014134	MF-712
117389	20:24916	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015028	MF-712
117397-Rev.1	20:24917	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015032	MF-712
117482	20:24006	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011694	MF-906
117608	20:24411	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013452	MF-901
117608-Rev.1	20:24422	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013461	MF-901
117609	20:24423	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013460	MF-901
117609-Rev.1	20:24424	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013453	MF-900
117772	20:23875	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011739	MF-700
117890	20:24007	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011764	MF-712
118104	20:24918	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014538	MF-712
118120	20:24051	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014366	MF-712
118151	20:24008	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014160	MF-712
118156-Pt.1	20:24919	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014537	MF-712; MF-704
118156-Pt.2	20:24920	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014536	MF-712; MF-704
118164	20:23932	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014124	MF-712
118185	20:24009	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014695	MF-704
118186	20:24052	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014684	MF-712
118192	20:23933	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014370	MF-712
118195	20:24394	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014369	MF-712
118267	20:23479	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011719	MF-900
118290	20:24378	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014159	MF-700
118517	20:24921	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014368	MF-712
118523	20:24922	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011766	MF-712
118609	20:24024	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013273	MF-405; MF-406
118610	20:24025	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013260	MF-405
118633	20:24551	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014512	MF-702
118762	20:24405	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014156	MF-900
118837	20:24923	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014517	MF-712
118841	20:23934	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014165	MF-712
119038	20:23371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011762	MF-403
119080	20:24010	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011697	MF-906
119165	20:24395	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014392	MF-900
119186	20:24153	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014157	MF-900
119216	20:23935	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013459	MF-404
119257	20:24053	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014158	MF-712
119301	20:24813	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011756	MF-701
119320	20:24379	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011755	MF-906
119347	20:23876	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014162	MF-712
119349	20:23947	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014516	MF-721
119407	20:24339	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014389	MF-900
119408	20:24340	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013265	MF-910; MF-906
119571	20:23936	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014454	MF-704
119611	20:24054	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014678	MF-712
119626	20:24055	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014675	MF-706
119627	20:24396	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014677	MF-712
119629	20:24056	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014371	MF-712
119634	20:24057	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014683	MF-712
119654	20:24425	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013458	MF-901
119687	20:23877	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013456	MF-904
119725	20:24058	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014674	MF-404
119739	20:23948	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014133	MF-702
119772	20:25015	OSTI; NTIS; GPO Dep.	E 1.99:	DE95007126	MF-705
119843	20:24881	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013428	MF-427
119844	20:23949	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013455	MF-904; MF-901
119975	20:23798	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014991	MF-700
120009	20:24011	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014367	MF-712
120152	20:23824	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014391	MF-900

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
120158	20:24341	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013425	MF-910
120177	20:24707	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011753	MF-708
120183	20:24706	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014365	MF-712
120259	20:23897	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013462	MF-404
120300	20:24012	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013268	MF-904
120308	20:23816	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013263	MF-920; MF-906
120469	20:24552	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013432	MF-702; MF-705
120527	20:25016	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011529	MF-700
120528	20:25017	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011530	MF-700
120593	20:23403	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014161	MF-900
120641	20:24704	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013431	MF-405; MF-406; MF-408
120645	20:24553	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013293	MF-901; MF-902
120646	20:23818	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013451	MF-902; MF-901
120677	20:23416	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013439	MF-701
120745	20:23799	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014395	MF-900
120857	20:24436	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014387	MF-700
120858	20:24437	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014385	MF-706
120862	20:24772	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014394	MF-900
120866	20:24438	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014386	MF-706
120867	20:24439	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014384	MF-706
120870	20:24440	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014396	MF-706
120927	20:24554	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011752	MF-902
120933	20:23249	OSTI; NTIS; GPO Dep.	E 1.99:	DE95011695	MF-902
120957	20:23250	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015106	MF-702
120966	20:23251	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013297	MF-902
120995	20:23252	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013427	MF-900
121009	20:24555	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014393	MF-400
UCRL-LR–					
119748	20:25018	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014132	MF-405
120950	20:23937	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014694	MF-403
UFIFT-HEP–					
94-18	20:24776	*See* DOE/ER/40272–213			
USGS-OFR–					
93-89	20:23253	OSTI; NTIS; INIS; U.S. Geological Survey, Earth Science Information Center, Box 25286, MS 517, Denver Federal Center, Denver, CO 80225(United States); GPO Dep.	E 1.99:	DE95011964	MF-814
94-586	20:23495	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013085	MF-403
94-638	20:23659	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013086	MF-403
UTNL-R–					
0313	20:23557	OSTI; NTIS; INIS		DE95789431	
WAPD-T–					
3054	20:23878	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014553	MF-504
3055	20:23879	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014554	MF-504
WAPD-TM–					
1633	20:23553	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013277	PC-522; PC-504
WHC-EP–					
0479-1	20:23254	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015658	MF-2030
0818	20:23255	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013515	MF-2030
0857	20:23333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012822	MF-2070
0859	20:24014	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015548	MF-2020
WHC-SA–					
2623	20:23372	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013487	MF-2030
2722	20:23709	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012574	MF-2000
2737	20:23256	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012565	MF-2020
2818	20:24738	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012572	MF-2000

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2856	20:23145	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011636	MF-2000
2887	20:23257	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016340	MF-2020
WHC-SD-C018H-ATP–					
004	20:23258	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014433	MF-2050
WHC-SD-C018H-ATR–					
002	20:23259	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014425	MF-2050
WHC-SD-CP-CR–					
036	20:23373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014309	MF-2000
WHC-SD-CP-MAR–					
002	20:23374	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013878	MF-2050
WHC-SD-CP-OTR–					
152	20:23146	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012580	MF-2050
153	20:23260	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012578	MF-2050
WHC-SD-CP-SDD–					
004-Rev.2	20:23375	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015547	MF-2000
WHC-SD-CP-TP–					
085	20:23147	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012579	MF-2050
WHC-SD-EN-AP–					
165-Rev.1	20:23261	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015656	MF-2010
185	20:23334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013880	MF-2010
WHC-SD-EN-WP–					
012-Rev.1	20:23262	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014429	MF-2070
WHC-SD-FF-CSER–					
004	20:23151	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012576	MF-2050
WHC-SD-FF-CSWD–					
055-Rev.1	20:23608	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014314	MF-2000
056-Rev.1	20:23609	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014313	MF-2000
WHC-SD-FF-HC–					
002-Rev.1	20:23263	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016341	MF-2050
WHC-SD-FF-MAR–					
001	20:23610	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013564	MF-2050
WHC-SD-FF-QAPP–					
005-Rev.1	20:23589	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014312	MF-2020
WHC-SD-GN-CSWD–					
30077	20:24949	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012584	MF-900
WHC-SD-GN-SWD–					
30003-Rev.1	20:24556	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012581	MF-502
30005	20:24833	OSTI; NTIS; GPO Dep.	E 1.99:	DE95012582	MF-905
WHC-SD-GN-UM–					
30005-Rev.1	20:25019	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013348	MF-905
WHC-SD-RTG-TC–					
006-Rev.1	20:24015	OSTI; NTIS; GPO Dep.	E 1.99:	DE95013904	MF-506
WHC-SD-SNF-ATR–					
005	20:23152	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015655	MF-2070
WHC-SD-SNF-DQO–					
004	20:23153	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014310	MF-2050
WHC-SD-SNF-DTP–					
001	20:23154	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012569	MF-2070

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WHC-SD-SNF-ER-					
006-Rev.1	20:23264	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015599	MF-2070
WHC-SD-SNF-PLN-					
007	20:23265	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015586	MF-2070
WHC-SD-SNF-SP-					
001	20:23155	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012570	MF-2070
WHC-SD-SQA-CSA-					
20392	20:23266	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014430	MF-714
20394	20:24016	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013340	MF-714
WHC-SD-TP-SEP-					
034	20:23376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012577	MF-2050
WHC-SD-TP-SWD-					
002-Rev.2	20:23156	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014432	MF-905
WHC-SD-TP-TP-					
007	20:24017	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014426	MF-513
WHC-SD-W079-ES-					
001-Rev.3	20:23267	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013883	MF-2030
WHC-SD-W236A-DA-					
002	20:23157	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014428	MF-600
WHC-SD-W236A-ES-					
014	20:23268	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012566	MF-2020
WHC-SD-W252-FHA-					
001	20:23269	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013889	MF-2000
WHC-SD-WM-ATP-					
128-Rev.1	20:23270	OSTI; NTIS; GPO Dep.	E 1.99:	DE95014423	MF-2030
132	20:23271	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016327	MF-2070
WHC-SD-WM-DA-					
148	20:23272	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015790	MF-2030
196	20:23273	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014422	MF-2030
WHC-SD-WM-DP-					
107	20:23274	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012568	MF-2070
111	20:23275	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012586	MF-2070
114	20:23276	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014307	MF-2070
115	20:23277	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016330	MF-2070
132	20:23278	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016329	MF-2070
WHC-SD-WM-ER-					
350	20:23279	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015546	MF-2070
366	20:23280	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014306	MF-2070
418	20:23281	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012592	MF-2070
419	20:23282	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012591	MF-2070
420	20:23283	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012571	MF-2070
422	20:23284	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012585	MF-2070
425	20:23285	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012593	MF-2070
426	20:23286	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012594	MF-2070
427	20:23287	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95014316	MF-2030
428	20:23288	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012824	MF-2070

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WHC-SD-WM-ER-					
429	20:23289	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012595	MF-2070
430	20:23290	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012823	MF-2070
432	20:23291	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012789	MF-2030
436	20:23292	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95016334	MF-2030
450	20:23293	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013911	MF-2070
458	20:23294	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013881	MF-2070
WHC-SD-WM-ES-					
325	20:23295	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015784	MF-2000
331	20:23296	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012567	MF-2030
337	20:23377	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95013837	MF-2030
343	20:23297	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95012588	MF-2030
345	20:23298	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95015819	MF-2030
WHC-SD-WM-FRD-					
021	20:23299	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE95011506	MF-2030
WHC-SD-WM-MAR-					
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WS Samoa

YE Yemen, Republic of
YU Yugoslavia

ZA South Africa
ZM Zambia
ZR Zaire
ZW Zimbabwe

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ED EANDC [European American Nuclear Data Committee]
EP European Patent Office
IO ILO [International Labor Organization]
IX IUPAC [International Union of Pure and Applied Chemistry]
QS INSPEC [Information Service in Physics, Electrotechnology and Control]
QZ INPADOC [International Patent Document Centre]
WO WIPO [World Intellectual Property Organization]
XA IAEA [International Atomic Energy Agency]
XC CERN [European Organization for Nuclear Research]
XD OECD [Organization for Economic Co-Operation and Development]
XE CEC [Commission of the European Communities]
XF FAO [Food and Agricultural Organization of the United Nations]
XH AAEA [Arab Atomic Energy Agency]
XI IIASA [International Institute for Applied Systems Analysis]
XJ JINR [Joint Institute for Nuclear Research]
XK WMO [World Meteorological Organization]
XN NEA [Nuclear Energy Agency of the OECD]
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